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NASA CR-175271

PERFORMANCE MANAGEMENT SYSTEM

ENHANCEMENT AND MAINTENANCE

Final Report for the period January, 1984 - November, 1984

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16. Abstract The research described in this report concludes a two-year effort to develop a Performance Management System (PMS) for the NCC computers. PMS provides semi-automated monthly reports to NASA and contractor management on the status and performance of the NCC computers in the TDRSS program. Throughout 1984, PMS was tested, debugged, extended, and enhanced. Regular PMS monthly reports were produced and distributed. PMS continues to operate at the NCC under control of Bendix Corp. personnel.			
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EXECUTIVE SUMMARY

This document contains a full description of the research conducted at the University of Louisville over the past year. The purpose of this research was to enhance and debug the current Performance Management System (PMS) for the UNIVAC 1100/82 at the NCC, and to extend PMS to operate on other computers at the NCC.

PMS provides a semi-automated system for generating monthly performance reports to NASA and contractor management. These reports summarize the activity of the operations partition of the UNIVAC 1100/82 at the NCC. This is the computer which supports TDRSS operations. The reports present tabular and graphical data showing such parameters as CPU utilization, memory utilization, and TIP thruput. These graphs and tables are accompanied by textual explanations.

Technical and administrative managers use the PMS reports to track the system's workload (for example, observing the change in workload during a shuttle launch), to anticipate system problems (for example, excessive utilizations which might threaten the system's reliability), and plan for system upgrades (for example, by observing which system resources are heavily or lightly used).

A PMS operator (currently from Bendix) must devote one to two days a month to perform the tape manipulation operations and report generation functions required by PMS. More time may be

required if system anomalies require research to explain the behavior in the PMS report, or if system malfunctions require special data recovery procedures.

During this research, PMS was debugged, and there are now no known instabilities in PMS. Furthermore, PMS was enhanced making it simpler, more reliable, and faster for the PMS operator. In particular, PMS now uses fewer tapes and is menu-driven. The current version of PMS is called PMSLR16. It is available in the NCC tape library on tape number 0754.

In order for PMS to be operated by personnel other than the developers at the University of Louisville, it was necessary to fully document its features. Therefore, the following three manuals have been generated under this contract:

Installation, Operation, and Maintenance Manual

Program Reference Manual .

File Reference Manual

Copies of these manuals have been delivered to the Technical Officer for this contract and the PMS operator at Bendix. Other copies are archived at the University of Louisville.

PMS is currently in operation at the NCC, and it should continue to provide useful information to management for years to come.

PMS2 was developed under this contract to extend PMS to operation on the backup partition of the 1100/82 and the development computer at the NCC, a UNIVAC 1100/80A. This new

PMS version is more general than the one in current operation. It monitors more system parameters and provides a more "generic" report. By reconfiguring system data files (not programs) it can be made to operate on any of the three UNIVAC 1100 configurations at the NCC. PMS2 has been tested, and has been shown to produce usable reports, but it has not been approved for implementation on the NCC computers. The University of Louisville PMS researchers recommend that steps be taken to approve and activate PMS2 for implementation on all the NCC UNIVAC 1100 series computers. It should provide the superior performance reporting capability for all these computers that is now provided only for the operations partition of the UNIVAC 1100/82.

There were no inventions developed under this contract. There were no subcontracts which contained Patent Rights or New Technology clauses.

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NOMENCLATURE

ARM - Archive Module
DTV - Digital Television
ECL - Executive Control Language
FEP - Front End Processor
GSFC - Goddard Space Flight Center
GSTDN - Ground Spaceflight Tracking and Data Network
MOMP01 - Manual Operation Module
NASA - National Aeronautics and Space Administration
NCC - Network Control Center
PDL - Program Design Language
PMS - Performance Management System
SIP - Software Instrumentation Package
STDN - Space Tracking and Data Network

1. INTRODUCTION

1.1 Statement of Problem

Under the extension of the National Aeronautics and Space Administration (NASA) Contract NAS5-26504 with the University of Louisville, the maintenance and further development of a semi-automated Performance Management System (PMS) was undertaken for the Network Control Center (NCC) of the Tracking and Data Relay Satellite System (TDRSS). PMS analyzes the major resources and system workloads of the NCC computer, a Univac 1100/82. The PMS system prepares and prints monthly reports documenting the performance of NCC's UNIVAC 1100/82.¹ It was desired by NASA that PMS's manual operations (the procedures required to produce the monthly reports) should be enhanced for smoother operation of PMS. The contract also required that PMS be extended so that it could evaluate all the NCC UNIVAC 1100 series computers at the NCC. This report describes in detail the enhancements and modifications performed on PMS to meet these requirements.

1.2 Background

Performance evaluation, the determination of how well a system is able to complete its specified tasks, is essential to the successful application of virtually every technology. System designers, installation directors, data processing and corporate members, system analysts, program

managers, and computer users at all levels have to cope with problems that could be solved substantially more easily and more satisfactorily with some knowledge of performance evaluation methodologies, techniques, and tools.²

All computer systems have to address problems that require considerable involvement in performance evaluation activities. For example, configuration design, system tuning, upgrading, scheduling, operation's management, and short and long term planning are important aspects involved in a computer system. As is the case with the NCC, the increasing complexity of modern computer systems, the increasing significance of tasks being delegated to computers and future upgrading to their system, have necessitated that computer system performance become an important consideration for their developers and those responsible for system operation.³

To analyze the performance of any computer system, the productivity, responsiveness, and utilization of the system must be quantified into a set of indices to be compared with performance standards. Methods used to determine these indices fall within three categories: direct measurement, simulation, and analytical techniques. Direct measurement uses monitors that sum events as they occur in the system and convert counter values to indices. Hardware or software monitors may be used. Hardware monitors use probes connected to the computer while software monitors are usually incorporated in the computer's operating system and

run concurrently with application programs. Simulation; the second method of evaluation, uses system specifications, information collected by monitors, or both to model the system's hardware and its workload. A simulation program which uses these modeled parameters imitates the system by reproducing a sequence of events which corresponds to actual events taking place in the system. A third method of performance evaluation using analytical techniques represents a system by a set of mathematical equations. These equations are developed using Markovian queuing network theory or operational analysis.⁴

All three performance methods have advantages over each other. Direct measurement is the most accurate, but requires an operational system. The system's hardware and software must be in the final stages of development. Simulation requires development of complex programs to simulate the target system. These programs take time to develop and debug, but they do not require the target system to be developed. Because the system's operation is imitated, simulation can produce results which are almost as accurate as direct measurement. Analytical techniques may produce results quickly, and such techniques are easily changed in response to system changes. They are usually not as accurate as simulation or direct measurement.

Performance indices for a system and modification assessments that can be produced quickly are useful for efficient system management.⁵

All three performance evaluation methods were used to evaluate the NCC computers in previous research at the University of Louisville under contract NAS5-26504. Chief responsibility for development of measurement methods, simulation, and analytical system modeling was undertaken by J. G. Darnley, G. G. Crush, and A. M. Longtively. The measurement methods gathered all the data from the NCC's computers necessary to perform the simulation and modeling experiments. The monitor used to gather this information is called Software Instrumentation Package (SIP). SIP accumulates and records most of the activities of the UNIVAC's operating system and hardware devices. Because data collected by SIP require very large files, data reduction programs were developed to reduce the SIP data into useable formats and also to produce performance summary reports from the UNIVAC 1100/22 then installed in the NCC. At this point, simulation and modeling programs analyzed the data-base created by SIP/PAR to evaluate the TDRSS network.⁶ As a result of the application of the above methods, it was determined that the UNIVAC 1100/22 used by NCC for TDRSS activity was inadequate, but an upgrade to an 1100/82 model would suffice.⁷

An outgrowth of the above research was a proposal to use the measurement methods to monitor the operations partition of the new UNIVAC 1100/82 and report on its performance. A system needed to be developed to obtain detailed analysis of the data-base that could be obtained

from SIP-collected data and FAR reduction of it. This system would be run periodically and would produce reports on the current status of the NCC's computers could be included in this new system. It was desired that the reports produced could be used by management, as well as technical specialists. The members of the team that designed the performance management system for the NCC were R. D. Shelton, T. G. Cleaver, A. M. Long, M. Shive, L. B. Drake, and A. B. Shah.⁸

The NCC's computers are a part of an extension to the existing Ground Spaceflight Tracking and Data Network (GSTDN) which is responsible for communications with low orbiting NASA spacecraft. To increase the satellite communications and coverage significantly, the TDRSS was designed because user satellites were frequently out of communication with any ground station. Another major advantage of TDRSS is that more modern technology is used than with STDN, so that a wider range of communication rates is provided. The Network Control Center controls and monitors are a part of the TDRSS system. The NCC has front end processors (FEP) which are UNIVAC Varian 77 600 minicomputers, and a custom digital TV (DTV) system which drives operator workstations. The NCC is built around a UNIVAC 1100/82 mainframe computer with dual processors that normally runs as a partitioned system, one processor for operation and the other for testing. There is also a UNIVAC 1100/80A mainframe computer used for software development.

The PMS system was developed for the NCC which is located at the Goddard Spaceflight center (GSFC).⁹

Throughout 1983, PMS was developed by the University of Louisville design team, and in October 1983, it was delivered to NASA/GSFC as an operational system. Below is a brief discussion of PMS as configured on that delivery date. More detail is available in the Final Report for 1983 (see bibliography).

The PMS system was broken down into seven modules. The first module which needed to be accessed when generating a performance report was the Manual Operations Module (MOM). This module prompted the PMS operator for information, such as the operator's name, report date, report period, and threshold values. Also, MOM set up the major units of PMS for execution.¹⁰

Data elements were stored in two classes of files: Internal Data Base and the External Data Base. The Internal Data Base contained all data files required during a run of PMS. The External Data Base contained the PMS system files that were stored on magnetic tapes, including the trend files. These trend files contained daily averages for parameters such as the NCC workload, CPU utilization, memory utilization, and utilization of the busiest disk drive. The Archive Module (ARM) automatically interfaced PMS's Internal Data Base and External Base.

The Data Reduction Module (DRM) reduced SIP performance data collected during the month. Raw

performance data was collected continuously by SIP and was written to data files as blocks of raw performance data every thirty minutes. A PAR program reduced the data collected from SIP, then created the Consolidated Data Base (CDB) files. The CDB files contained performance data for an entire report period. These data were chronological, and if data were missing for any time period, flags were provided.¹¹

The Report Generation module produced the monthly performance report. (See the Installation, Operation, and Maintenance Manual, Appendix I for an example of a typical report.) Two tables were contained in this report: Busiest Day Summary and Daily Average Report. The Daily Average Report gave a summary of daily performance averages during an entire month. The Busiest Day Summary table reported on the busiest day during the report period. This day could be specified by the PMS operator.

There were scatter plots in the monthly report for CPU, memory, and disk utilization. These scatter plots showed how the major resources relate to each other. Trend graphs were contained that reported on the NCC's CPU, memory, and highest disk utilization during the report period. Conditional reports were automatically plotted if threshold values were exceeded. These values were manually set by the PMS operator in the Manual Operations Module. It was possible to plot up to 25 conditional reports.

A Performance Monitor Module (PMM) along with MOMP01

allowed the PMS operator to start and stop the PMS software at various stages when generating the monthly report. This was helpful when testing and debugging the PMS system. When data integrity errors occurred when executing PMS, the PMM would stop execution and provide error statements for unrecoverable errors.¹²

The Maintenance Module (MAM) made it easier for the PMS operator to maintain the PMS system. This included maintenance of command files which compile and link programs. The PMS monthly performance report and the system programs could be printed on the UNIVAC's line printer by executing the appropriate command files. Also contained were PAR programs that enabled the operator to determine if a SIP cycle file could be reduced by PMS.

PMS was not a general system and would only evaluate NCC's UNIVAC 1100/82 operations partition. PMS could not reduce data from the backup partition of the UNIVAC 1100/82 or a UNIVAC 1100/80A computer. As of December, 1983, PMS would reduce Software Instrumentation Package (SIP) cycles properly and produce a satisfactory monthly performance report as described. PMS required at least four magnetic tapes: a system tape, two trend tapes (one used for the purpose of positioning the other one) and a SIP tape or tapes. Data copied on the SIP tape was collected using the Software Instrument Package, located on the UNIVAC 1100/82. The data collected required reduction of large amounts of performance data which would eventually be used in the PMS

monthly performance report. The trend tapes contained reduced performance data from the previous three months. The system tape stored all programs and maintenance routines contained in the PMS system. PMS required a minimum of human input to generate a monthly report. PMS was designed modularly to help with debugging and future modifications to the system.

The modular design of PMS helped limit the size and functions of all its software routines. The modules and units were designed with minimum interface between each unit. This allowed for changes to be made to the system by changing small programs instead of large ones. Ease of future developments to PMS was increased because of the flexibility designed into the system.

1.3 Preview of Report

The following text will describe the major modifications made to the PMS system. In the first section, the design methodologies used by developers of PMS are discussed. Then bugs found in PMS and enhancements made to PMS are discussed. Finally, the development of the new general version of PMS, which runs on all NCC 1100 series computers, is discussed.

2. MAINTENANCE OF PMS

2.1 Preliminary Activities

In accordance with the statement of work for this contract, the project team produced monthly PMS reports for the first six months of the contract. This activity had the following beneficial effects:

1. New team members gained experience in learning and using PMS.
2. High-quality monthly performance reports were prepared and distributed.
3. It provided a training period for the Bendix Corp. personnel who were to take over the operation of PMS.
4. System instabilities were detected and eliminated.

As a consequence of producing these monthly PMS reports, an important and interesting anomaly was noted in the behavior of the UNIVAC 1100/82. The CPU percent utilization would vary between two levels, 10% and 70%. This "bimodal" behavior was interesting in that it obviously represented some sort of "thrashing" or "deadly embrace" phenomenon, and it was important in that excessively high CPU utilization threatens the reliability of the computer system.

Subsequent studies indicated that the problem may

have been caused by competition for resources between SIP and OSAM. In accordance with this presumption, OSAM use was cut back severely, and the PMS reports reflected a reduction in the bimodal activity. Still, the University of Louisville staff regard the source of the problem to be unproved, and we continue to recommend that definitive tests be performed.

2.2 Debugging the PMS System

PMS is a large and complex software performance system. When dealing with programs on this scale, bugs in a system are inevitable. PMS was written modularly with the application of "top down" design techniques. This eased the difficulty in finding errors in the system.

The first major bug that was corrected was found when generating the 1983 December report. PMS had difficulty in creating files needed to produce the December monthly report. Apparently, PMS did not handle new year transitions properly. The error was found in Data Reduction Module DRMPR4. A logical condition was tested improperly. When the first month of the year was calculated, it was defined as thirteen. Consequently, all subsequent months calculated were offset by one (the second month of the new year is calculated as the first month). The system was corrected and tested again, but the monthly report still could not be produced. Later, it was discovered that a

trend file had a date that was out of sequence. The bad datum was corrected and PMS was executed, this time producing a correct monthly report.

Program module ARMEI3 did not close a file called "MISCELLAN" properly, generating an error when other modules read the file. MISCELLAN contains five records. After ARMEI3 finished writing the fourth record into MISCELLAN file, the file was closed; thereby, altering the number of records in the file from five to four. Any program that tried to read a fifth record in the MISCELLAN file would generate an error. To correct this error, ARMEI3 was changed to write a dummy fifth record in the MISCELLAN file.

A scheme was prepared for avoiding an annoying message. When PMS had difficulty handling a SIP cycle, a program module occasionally generated a message "****DRMFBL#3 -- NONFATAL ERROR IN READING SPHISTORY" to the terminal. PMS may even be in an infinite loop when this message appears on the screen. After this message is displayed several times on the monitor, the PMS system operator wonders if a SIP cycle cannot be reduced. If the SIP cycle cannot be reduced, it should be marked for skipping and PMS should be run again. To help the operator make this decision, the PMS software was corrected so that the error message is written to the monitor once, then it is written to a file called "TRACER" along with a counter, so that the number of times the error message occurs is readily apparent. If the PMS system is in an infinite loop trying

to reduce a SIP cycle, the DRMFBI error message can only be written into the TRACER file several thousand times. Once there is an overflow in the TRACER file, the PMS system will crash. The PMS operator will then know that a particular SIP cycle cannot be reduced, and will mark this cycle for skipping before running the system again.

Once modifications were made to the PMS system, they were documented. Change Request forms were filled out to reflect changes made to the system. The program's PDL was also changed to show the new logical flow of its modified program. Overall, the PMS system did not have any major errors. Changes made to PMS were subtle modifications, but necessary if PMS was to operate reliably.

2.3 Enhancing the PMS System

Previously, PMS was not especially user friendly. This made it difficult for beginning PMS operators to run the system properly. An indepth knowledge of PMS and UNIVAC ECL was required to produce satisfactory PMS reports consistently. This is especially apparent when trying to run the Report Generation module to produce the tables and graphs contained in the reports.

In order to increase PMS ease of operation, it was decided that PMS should be accessed through a menu driven program. The menu program executes all pertinent procedures of PMS to ensure PMS proper operation. By having a menu driven program of the major operations of PMS, the operator will be more aware of the types of operations that PMS can

perform since these operations are listed in the menu program. An indepth knowledge of how PMS functions operate is still required of the PMS operator when problems develop, but the menu program makes it easier for the operator to be competent in routine operation of PMS. He is more aware of the different functions PMS is allowed to perform.

The menu program is a FORTRAN program (See the Program Reference Manual for a complete listing) that is automatically executed by the procedure that loads the PMS system from magnetic tape to disk files. Through the menu program, PMS may be set up for operation and executed. The menu program has 15 options. Option A deletes all the files needed by MOMP01. Normally, the files used in the execution of MOMP01 are handled properly, but if there is a problem when executing MOMP01, this option is selected. It will allow the user to start from scratch and enter a new set of parameters in MOMP01. Option B allows a user to set up the PMS system for a monthly performance report run. This involves entering the operator name, beginning and ending dates of the monthly report, SIP cycles to be used by PMS, threshold values for devices configured on NCC's UNIVAC 1100/82, and modules of PMS selected for execution. Option C executes the PMS system. The modules of PMS that will be run are determined in module MOMP01. When changes need to be made to any program in PMS, Option D will compile the edited program. Once modified programs are compiled, Option E may be selected to map (link) the entire PMS system. If

it is desired to save PMS on any tape number, especially after modifications are made to PMS, Option F may be selected. To obtain a complete listing of all programs and ECL command files contained in the PMS system, Option G is selected. To print the monthly performance report generated by PMS, Option H is selected. The monthly performance report is sent to the UNIVAC's main line printer. Option I gives instructions on how to execute the PARQA. PARQA determines whether a particular SIP cycle may be used by PMS. Whenever an operator desires a listing of files currently on a magnetic tape, Option J may be used. The operator only needs to input the number of the tape he wants to look at. As PMS is used, the two work files (PMS and UTILITIES) accumulate an excessive number of versions of a file element. In order to minimize the disk space usage of PMS, Option K is selected to delete all file elements, except the most recent version. Option L concentrates two files, 66 columns each, into a file of 132 columns. The interlaced files are used as documentation in the PMS monthly performance report. Option M performs a catalog that lists disk files created under a user's account number. A catalog is performed periodically so that the PMS operator can delete unwanted files to conserve disk space. Option N lists the current disk file usage of a user while logged on a UNIVAC 1100 series computer. This option is helpful to the operator in case PMS does not execute successfully. The operator can determine if all files needed by PMS were

assigned. Option O exits the menu program and returns the user to the UNIVAC's operating system.

At the NCC, there was a limit for how much disk space each user is allocated. Because of the size of the PMS system, the disk space allocated for PMS was nearly full. PMS was analyzed to determine where in the system disk usage could be minimized. Previously, PMS copied SYSBAL\$LOG\$ files from tape to disk even if they are designated to be skipped by module MOMP01. A scheme was prepared in the ARM units to prevent loading in the SIP files to disk that will be unused in a monthly report run. This greatly reduced the disk usage of PMS.

Originally, the PMS system operated using three tapes: two trend tapes (which stored trend files) and a system tape (which stored the system files such as PMS and UTILITIES). When the system tape and trend tapes were changed periodically to save a new version of PMS files and trend files, this created difficulty for the PMS operator. It was easy for the operator to specify incorrect tape numbers that were to replace the former ones. This arises from the fact that modules which reference the system and trend files had the tape numbers hardcoded into their modules. If new trend tapes were to be used, the operator had to change the tape numbers in the programs. A new system tape required changing a tape number in an ECL command file that stores the PMS system from disk files to magnetic tape.

A further problem was that the use of three tapes was inconvenient and error-prone. The mounting and dismounting of three tapes by the UNIVAC operator took a long time, and the tape drives used were not always reliable. Changes were undertaken so that the files contained on the system and trend tapes would be stored on a single tape.

Changes were also made so that the user is now prompted for the system tape number the PMS system is to be stored on. Once all modules of PMS are executed, the system is saved on the specified tape number. The entire system is then deleted. This procedure forces the PMS operator to reload the PMS system every time he wants to generate a monthly report and reduces the chance that files needed by the system are rolled out. Once the PMS system is loaded from tape to disk the menu program is executed so that the operator can immediately select which functions of PMS he wants to perform.

The enhancements discussed make PMS more reliable and faster running. Also, the system is contained on one tape (including the trend files) and is more automatic since the operator no longer concerns himself with the correct trend tape numbers needed by the ARM units.

2.4 Documentation of PMS

Once all enhancement developments were performed on PMS, three documents were produced:

PMS Installation, Operation, and Maintenance Manual

PMS Program Reference Manual

PMS File Reference Manual

Copies of these three documents have been provided to NASA and Bendix. Other copies are on file at the University of Louisville.

The Installation, Operation, and Maintenance Manual describes PMS operator procedures. Guidelines for installing, running and maintaining PMS are included. The operator is shown how to access SIP cycles on the UNIVAC 1100/82, then store them to magnetic tape(s). Once the SIP tape(s) are created, procedures describe how to determine the valid SIP cycles to be used in a PMS monthly performance report run. There is also an error recovery section that explains operator recovery options in case difficulty should arise while running the PMS system. Next, there is a brief description of the internal function of PMS. There is also an explanation of the chronological execution of the PMS system, while PMS generates a monthly performance report. The last section describes maintenance of PMS. Instructions are given that show how to compile programs, map (link) programs, minimize PMS disk usage, and save the PMS system on magnetic tape.

The Program Reference Manual gives listings of the PDL and code for all PMS programs, including supporting utility programs. This will serve as the primary reference for system modifications and enhancements.

The File Reference Manual provides descriptions of

all data files used by PMS. It includes file formats,
variable names, and sample listings.

3. BENCHMARK TESTING WITH SHORT SIP INTERVALS

Bendix and CSC recognized that PMS reports provide performance data in a convenient and readable form, and that PMS reports could be produced much faster (one day) than other performance reports. They were therefore interested in using PMS to aid in analyzing benchmark tests and V and V tests on the 1100/82. Both Bendix and CSC requested that the University of Louisville personnel determine if PMS could be applied to such tasks.

PMS is configured to process SIP data taken at 30-minute SIP intervals over a period of several days. Benchmark and V and V tests use one-minute SIP intervals over a few hours. It was questionable whether PMS could easily be adapted to these short SIP intervals.

A test run of PMS with one-minute intervals was attempted. PMS processed the one-minute SIP intervals without difficulty. Normal PMS procedures were used to produce a PMS monthly report. Only three to four hours of data could be processed because the file generated by SIP would become too large for PMS to handle. The report produced using the one-minute SIP interval cycle contained all the tables and graphs normally generated by PMS. The trend graphs and Daily Average Report table produced trivial results because these graphs and tables are designed to summarize data for up to one month. Since only three to four hours of SIP data were used, the cycle was much too small to obtain meaningful results. In the Busiest Day Summary

table and other standard report graphs, useable data was recorded for memory, CPU, and highest disk utilization. Also, the conditional graphs that plot threshold parameters vs. time of day were successful. The resolution of the graphs was coarse because PMS summed the one-minute SIP interval raw performance data into 30-minute time slots.

It was determined that, with suitable modifications, PMS could be reconfigured to provide useful reports on benchmark tests. This remains an area of possible future research.

4. TRAINING OF A PMS OPERATOR

At the onset of the this year's research, NASA specified Bendix as the contractor who would eventually take control of the operation of PMS and the distribution of monthly PMS reports. In accordance with the contract, University of Louisville personnel undertook the training of the Bendix operator, E. Z. Block.

Throughout the first half of 1984, the Bendix operator observed and assisted in the generation of monthly PMS reports. He became familiar with PMS operation, the gathering of SIP data, and the tape handling routines.

In June of 1984, the operation of PMS was turned over to Bendix. In July of 1984, Bendix released its first PMS report, the report for the month of June.

As changes and upgrades to PMS were developed, the new releases were issued to Bendix. PMS reports continue to be generated by their PMS operator.

5. PMS2: DESIGN OF A GENERAL PMS SYSTEM

The PMS system described in the previous section was designed specifically to analyze data from the operations partition of the UNIVAC 1100/82. The contract required that PMS be extended so that it would operate on the backup partition of the 1100/82 and also on the 1100/80A, a software development machine.

5.1 Design Criteria

After extensive interviews with NASA and contractor personnel to determine the form and content of the new PMS, it was decided that PMS should, as nearly as possible, be the same for all three configurations. Differences among the three machine configurations would be handled by selecting different options and data files, but the PMS programs would remain the same for all three. This new PMS was dubbed "PMS2".

In order for PMS to run as a general performance system that could evaluate the NCC UNIVAC 1100 series computers, some of PMS's parameter specifications needed to be changed to match the environment of all three. All of the new parameters needed to be common for all the NCC UNIVAC installations. The parameters that were determined to be most useful were CPU utilization, memory utilization, average disk utilization, TIP throughout, TIP response time, demand terminals in use, demand response time, and batch jobs open. The PMS report given in Appendix C, however,

includes FEP and DTV information since these parameters are valuable for the NCC's 1100/82, for which the mentioned report was produced. The parameters which are general enough to be included in the new PMS tabular output were listed earlier and the three new parameters, demand terminals in use, demand response time, and batch jobs open, can easily overwrite the DTV and FEP data tabulated in the Report Generation module of PMS in a step towards the universalization of PMS.

5.2 Implementation

PMS1, the version of PMS which runs exclusively on the UNIVAC 1100/82, was used as the foundation for PMS2. The first task was to redesign the PAR reduction unit, DRMPR4, to acquire the additional parameters required of PMS2.

Although acquisition of TIP response time and demand response time were challenging problems, they were eventually acquired and DRMPR4 successfully passed its integration test. A listing of DRMPR4 is given in Appendix A.

DRMFRU, the Fortran Reduction Unit, had to be completely rewritten for PMS2. This complex and lengthy program creates the SPHISTORY file which is a structured SIP Data History. Fields of SPHISTORY represent the different parameters collected by PMS. The created SPHISTORY file is used by the FORTRAN Data Base Unit (DRMFB1, DRMFB2), to create the Consolidated Data Base files used by the rest of

PMS. The program is extensively commented and has detailed PDL. The listing of the program is given in Appendix B.

In order to make the new desired parameters available to PMS by the PAR reduction routines, a number of files had to be entirely reformatted. These files, namely PARAMADEF, PARAFLNMS, and THRESHOLD were each modified to include, respectively, a definition of the new parameter (needed to identify it from other parameters in PARDATAFL), the name given to the file which will be used to accumulate data at various times for the parameter, and a threshold setting, which, when exceeded, will trigger the generation of a conditional report for the parameter.

An entirely new file, called SYSCONFIG, was created. This file was developed in an effort to probe some crucial characteristics of the system which could then be displayed on the cover page of the PMS report. The existence of such a file became particularly desirable due to the need to identify a system report for the 1100/80A. The four records of this file are:

TOTEM: The main memory size of the system.

NUMCPU: Number of CPUs configured for a day.

EXLEV1: Executive level for a day.

DSKCNT: Number of disks up.

Upon completion, PMS2 was tested with a subset of the data for the month of August, 1984. The resulting PMS report is given in Appendix C.

The sample report produced by PMS2 proves that it can be successfully applied to performance management for NCC computers. Consideration should be given to applying PMS2 operationally on all the NCC UNIVAC computers.

5.3 Toward a Universal PMS System

In May of 1984, University of Louisville personnel presented the current research at a meeting of the UNIVAC users' group, USE.¹³ PMS2 was described, and its extension to PMS3 was also described. PMS3 was to be a version of PMS which would be able to run on any UNIVAC 1100 series computer, not just those at the NCC.

We received twenty-six requests from systems managers of UNIVAC installations to be beta test sites for PMS3. It is clear from this that there is great demand for a software tool of this kind.

As the present contract is expiring, we have no immediate plans to develop or release PMS3, but this remains a possible avenue of future research.

6. CONCLUSIONS

PMS has been an operational system since November of 1983. Although PMS could produce monthly performance reports at that time, a beginning PMS operator without much experience using the system would have some difficulty generating a PMS report. The enhancements made to PMS simplify the user's interface. An operator can now generate PMS reports without detailed knowledge of the internal operations of PMS. Documentation on PMS is now supplied to help the operator in case difficulties arise when executing PMS. The operator now has standard procedures to follow when installing, maintaining, and operating PMS. PMS is a more automatic system because the entire system is now contained on a single tape. By having the operator prompted for the tape number of the system's tape, errors are reduced when running PMS. All known bugs in PMS have been eliminated, thereby significantly increasing the reliability of PMS.

PMS is a viable and valuable tool for performance analysis of the UNIVAC 1100/82. It should continue to provide PMS monthly reports to NASA and contractor management into the foreseeable future.

PMS2, the general PMS system, is ready to provide performance analysis for all UNIVAC 1100 series computers at the NCC.

APPENDIX A

PROGRAM LISTING

PMS2*PMS.DRMPR4

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1 1) UNIT ALLOCATION NAMES: SPPFRA (RAW SIP TO PAR HISTORY FILE)
2 2) (PAR LANGUAGE PROGRAM)

3 3) PURPOSE: TO CON-BIT SIP PRODUCE PERFORMANCE DATA INTO FIXED FORMAT
4 4) HISTORY FILE

5 5) INVOCATION SEQUENCE: READ.PAR,CP.SIPFIL,TPFS-PPS.CRMPC4,TPFS,
6 6) CRMPC4 "NAME"

7 7) EXTERNAL UNITS/SUBDIVISIONS OF THIS MODULE:
8 NAME FUNCTION CALLED BY CALLED LANGUAGE
9 GETIV POSITION TO NEXT TIME RSTFHIST - PAR
10 10) INTERVAL OF SIP DATA
11 SCALE SCALES COUPLE WORD INTO BASLIV,ANALIV - PAR
12 12) A SINGLE WORD
13 INITIV ALLOCATES ARRAYS AND RSTFHIST - PAR
14 14) INITIALIZE DATA ITEMS
15 BASEIV BASES DATA FROM A TIME RSTFHIST SCALE PAR
16 16) INTERVAL CLOCK FOR DIFFERENCE
17 ANALIV ANALYZES (SUBTRACTS) THE RSTFHIST SCALE,WRITIV PAR
18 BASE DATA FROM NEXT CLOCK
19 WRITIV OUTPUTS A TIME INTERVAL TO ANALIV - PAR
20 20) THE HISTORY FILE

21 21) INTERMEDIATE VARIABLE(S):
22 NAME DESCRIPTION
23 HIST ELEMENT IN OUTPUT FILE
24 INTLEN LENGTH OF COLLECTION PERIOD IN MINUTES

25 25) FILE/ELEMENT REFERENCES:
26 FILE/ELEMENT NAME USE CONTENTS
27 SIPFIL I RAW SIP PERFORMANCE DATA
28 TPFS,NAME C ELEMENT OF REDUCED SIP DATA
29 FROM FILE SIPFIL.

30 30) DEVELOPMENT HISTORY:
31 AUTHORS
32 F.E. STURGEON,J.R. CARNLEY REC: APPENDIX I INITIAL DRAFT 3/17/83
33 HIPO: CRM SECOND DRAFT 3/31/83
34 34) THIRD DRAFT 5/5/83
35 35) CHANGED VIA CHANGE REQUEST E4-1 3/10/84
36 36) CHANGED 7/3/84 FOR GENERAL PMS SYSTEM

37 37) UNIT FLAG
38 -----
39 39) OPEN OUTPUT HISTORY ELEMENT TPFS,NAME
40 40) ALLOCATE INTERNAL ARRAYS FOR STORING INTERMEDIATE RESULTS
41 41) INITIALIZE VARIABLES TO ZERO (SEE MODULE INITIV)
42 42) GET AN INPUT DATA CLOCK FROM SIPFIL
43 43) DO UNTIL SUMMARY BLOCK OR READ ERROR OF EOF
44 44) USE THIS CLOCK (SEE MODULE BASEIV)
45 45) GET NEXT CLOCK (SEE "MODULE GETIV")
46 46) IF NEXT CLOCK VALUE (NOT SUMMARY OR ERROR OR EOF)
47 47) THEN
48 48) ANALYZE NEXT CLOCK AGAINST BASE DATE (SEE MODULE ANALIV)
49 49) OUTPUT RESULTS OF ANALYSIS TO TPFS,NAME (SEE "MODULE WRITIV")

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100    1 END IF
101    2 END DO
102    3 CLOSE OUTPUT FILE,NAME
103    4 END C
104
105    5 FUNCTION SIZE=0.7
106    6 LINESIZE=120
107    7 INTLLEN=120
108    8 INTLE=100
109    9 FUNCT CFMPC4 PELT
110    10 INTRTC:=INTLLEN/100.0
111    11 ITIMSTP[0]//472.00000
112    12 READ
113    13 ITIMC:=((ITIMSTP[0]//432.00000)-1)/E  E INTERVAL ROUND UP FACTOR
114    14 NINC
115    15 READ
116    16 CTIML:=ITIMSTP[0]//472.00000
117    17 INTVNO:=(CTIME+INTRTC)/INTRTC
118    18 ITINTV:=INTVNO
119    19 SYR:=SYTCAY[1,57]+64
120    20 SMC:=SYTCFY[1,57]
121    21 SCAT:=SYTCAY[1,52]
122    22 SCATE:=100*((1LC-SYF)+SMO)+SCAT
123    23 INTIV
124    24 PCFFN PELT
125    25 IMEM:=MEMSIZE+64
126    26 INTVNO:=INTVNO-1
127    27 WHILE ETYPE<63
128    28     BASEITV
129    29     GETNIV
130    30     IF INTVNO>0
131    31         ANALIV
132    32     ENDIF
133    33 ENDWH
134    34 PCLOSE
135
136    35 END
137    36 FUNCT GETNIV
138    37     NT:=(INTVNO+2)*INTRTC
139    38     WHILE 1
140    39         READ
141    40         IF ISTAT<>0
142    41             J:=BLOCK
143    42             REWIND
144    43             READ I
145    44             ETYPE:=62
146    45     ENDIF
147    46     NTI"E:=TIMSTP[0]//432000000  E THE TIME STAMP FOR THIS BLOCK
148    47     IF ACTIME < CTIME
149    48         NT:=NT//432000000
150    49     ENDIF
151    50     IF ETYPE=67
152    51         I:=NT+INTRTC
153    52     ELSE
154    53         I:=ACTIME+INTRTC
155    54     ENDIF
156    55     LEAVE ETYPE=C
157    56     LEAVE IONI
158
159    57 ENDIN

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114 INTVTPM:=ACTIME-CTIME
115 CTIME:=ACTIME
116 INTVNO:=J/10/TRTC -1
117 IF INTVTPM<_
118 INTVTPM:=INTVTPM+4.2E-11
119 SCAY:=SCAY+1
120 IF SCAY > DAYMO(SMO)
121 SCAY:=SCAY-DAYMO(EMC)
122 SMC:=SMC+1
123 IF SMO > 1,
124 SMC:=SMC-10
125 SYR:=SYR+1
126 E1,IF
127 ENDIF
128 E2,IF
129 SDATE:=1.0*((TLC*SYR)+SMO)+SDFY & SJF COLLECTION YYMMDD
130 END
131 FUNCT SCALE X,Y & SCALE A DOUBLE WORD INTO SW
132 UWS:=X
133 LWS:=Y
134 LWS:=LWS/61.0 & SCALE DOWN BY 512
135 RAD:=(Y*57777)/400 & ROUND UP
136 IF LWS<0
137 LWS:=LWS+577777777 & THE HICKLIN FIX
138 ENDIF
139 UWS:=UWS+1000000*LCW
140 SW:=UWS+LWS+FNC & STORE COMBINED RESULT
141 END
142 FUNCT INITIV & ALLOCATE ALL ARRAYS NEEDED
143 ALLOCATE BP1,NCAU,BPC2,NCAU,BPC3,NCAU,BP34,NCAU,EPPS,NCAU,;
144 BPC5,NCAU,BPC7,NCAU,BPC8,NCAU,BF09,NCAU,BP1C,NCAU,;
145 BP11,NCAU,BF12,NCAU,EP13,NCAU,BF14,NCAU,BP15,NCAU,;
146 BP16,NCAU,BF17,NCAU,EP18,NCAU,EF19,NCAU,BP20,NCAU,;
147 BP21,NCAU,BF22,NCAU,EP23,NCAU,BF24,NCAU,BP25,NCAU,;
148 BP26,NCAU,BP27,NCAU,EP28,NCAU,EF29,NCAU,BP30,NCAU,;
149 EP31,NCAU,BP32,NCAU,EP33,NCAU,EF34,NCAU
150 ALLOCATE FCL1,NCAU,PCL2,NCAU,FC03,NCAU,FL04,NCAU,FC05,NCAU,;
151 PC06,NCAU,PCL7,NCAU,FL06,NCAU,FL07,NCAU,PC11,NCAU,;
152 PC11,NCAU,PCL12,NCAU,FL12,NCAU,PC14,NCAU,PC13,NCAU,;
153 PC16,NCAU,PC17,NCAU,FL16,NCAU,PC19,NCAU,FL20,NCAU,;
154 PC21,NCAU,PC22,NCAU,FC21,NCAU,FC24,NCAU,PO25,NCAU,;
155 FL26,NCAU,PC27,NCAU,FUZ2,NCAU,PC29,NCAU,PUZ3,NCAU,;
156 FZ31,NCAU,PC32,NCAU,FL32,NCAU,PC34,NCAU
157 ALLOCATE BIUL1,NIOU,EIUC2,NIOL,BIUL2,NIOL,JIU04,NIOU,EIUC5,NIOU,;
158 JIU05,NIOU,EIUC7,NIOL,BIUL3,NIOL,JIU06,NIOL,EIUC9,NIOU,EIUC10,NIOL,;
159 BIUL11,NIOU,EIUC12,NIOL,JIU07,NIOL,JIU08,NIOL,JIU09,NIOU,EIUC11,NIOL,;
160 BIUL15,NIOU
161 ALLOCATE JU011,NIOU,JU013,NIOL,JU03,NIOL,JIU04,NIOU,JIU05,NIOU,;
162 JU06,NIOU,JU07,NIOL,JU08,NIOL,JU09,NIOU,JIU10,NIOL,JIU11,NIOL,;
163 JU012,NIOU,JU013,NIOL,JU014,NIOU,JIU15,NIOU,JIU16,NIOU
164 JU017,NIOU
165 ALLOCATE SLC1,NLC,ELCC2,NLC,LC01,NLC,LC02,NLC
166 ALL CATE BUT01,NUUNITS,BUT02,NUUNITS,BUT03,NUUNITS,BUT04,NUUNITS,;
167 BUT05,NUUNITS,BUT06,NUUNITS,BUT07,NUUNITS,BUT08,NUUNITS,;
168 BUT09,NUUNITS
169 ALLOCATE UT01,NUUNITS,UT02,NUUNITS,UT03,NUUNITS,UT04,NUUNITS,;
170 UT05,NUUNITS,UT06,NUUNITS,UT07,NUUNITS,UT08,NUUNITS,;

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        S1AVFG(1):=S1A
        ENDIF
        E1T1KUWKA$P1D
        L1:=128.
        FOR P1:=1 TO THE
          P1:=44+4*CHN$HT[1]
        D1$P1F
        E1T1KUWKA$P1D
        FCA 1,1,12
          S1A:=#L(44+SCSWFT[1])
        ENDFOR
        FOR I:=1,NCAU-1
          S1I1C(1):=LSLTM(LCN1,I)
          S1I2C(1):=LSLTM(LEXCDE,I)
          SF16(1):=LSLTM(LAT1,I)
          SF17(1):=LSLTM(LLTF,I)
          EF1c(1):=LSLTM(LLCLN,I)
          SF19(1):=LSLTM(LLATCH,I)
          SF20(1):=LSLTM(LLCEN,I)
          SF21(1):=LSLTM(LLGPOL,I)
          SF22(1):=LSLTM(LL,I)
        ENDFOR
        FOR I:=1,NACU-1
          S1I1C(1):=SBCMRG[1,1]
          SCALE SLCMWDC[1,1],SECMMW[1,1]
          S1I2C(1):=S1W
          S1I3C(1):=SBCMRG[1,1]
          SCALE SECMMW[2,1],SBCMW[2,1]
          S1I4C(1):=S1W
          S1I5C(1):=SBCMRG[2,1]
          SCALE SLCMWDC[4,1],SECMMW[5,1]
          S1I6C(1):=S1W
          S1I7C(1):=SBCMRG[3,1]
          SCALE SLCMWDC[6,1],SBCMW[7,1]
          S1I8C(1):=S1W
          S1I9C(1):=SBCMRG[4,1]
          SCALE SLCMWDC[8,1],SECMMW[9,1]
          S1I10C(1):=S1W
          S1I11C(1):=SBCMRG[5,1]
          SCALE SLCMWDC[10,1],SECMMW[11,1]
          S1I12C(1):=S1W
          S1I13C(1):=SBCMRG[6,1]
          SCALE SLCMWDC[12,1],SECMMW[13,1]
          S1I14C(1):=S1W
          S1I15C(1):=SBCMRG[7,1]
          SCALE SECMMW[14,1],SECMMW[15,1]
          S1I16C(1):=S1W
        ENDFOR
        FOR J:=1,NUM17C-1
          S1LT1C(J):=SEURELL[1,J]
          S1LT2C(J):=SEURELG[1,J]
          S1LT3C(J):=SEUTERL[1,J]
          S1LT4C(J):=SEUTERH[1,J]
          S1LT5C(J):=SEUTERF[1,J]
          S1LT6C(J):=SBL2X1[1,J]
          S1LT7C(J):=SBL2UL[1,J]
          S1LT8C(J):=SBL2UE[1,J]
        ENDFOR
        C  COUNT NUMBER OF AFS
        C
        C LOOP FOR ALL PROCESSORS
        C EXEC 1 ACTIVE TIME
        C EXEC 1 ACTIVE TIME
        C REAL TIME ACTIVE
        C T/F ACTIVE
        C DEADLINE BATCH TIME
        C BATCH TIME
        C DEMAND TIME
        C PROCESSOR IDLE TIME
        C EXEC 3 ACTIVE TIME
        C
        C LOOP FOR ALL IOU'S
        C REQUEST THRU CHN 1
        C # 1CC WD BLKS THRU CHN 1
        C REQUEST THRU CHN 1
        C # 1CC WD BLKS THRU CHN 1
        C REQUEST THRU CHN 2
        C # 1CC WD BLKS THRU CHN 2
        C REQUEST THRU CHN 3
        C # 1CC WD BLKS THRU CHN 3
        C REQUEST THRU CHN 4
        C # 1CC WD BLKS THRU CHN 4
        C REQUEST THRU CHN 5
        C # 1CC WD BLKS THRU CHN 5
        C REQUEST THRU CHN 5
        C # 1CC WD BLKS THRU CHN 6
        C REQUEST THRU CHN 6
        C # 1CC WD BLKS THRU CHN 6
        C REQUEST THRU CHN 7
        C # 1CC WD BLKS THRU CHN 7
        C
        C FOR ALL UNITS
        C INPUT REQUEST FOR UNIT
        C OUTPUT REQUEST FOR UNIT
        C AWAKE INPUT FROM UNIT
        C F WFC'S OUTPUT TO UNIT
        C DATA TRANSFER TIME
        C EXISTENCE TIME
        C REQUEST CUED
        C CUMULATIVE QUEUE SIZE

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267      S100F
268      END
269  FUNCT ANALY
270    CLRTIM:=TIME*TP[7]/100
271    V1C1:=INTVTH/2
272    ACFTCT:=UFDTCTD-EUPACT
273    V1C3:=#RTFX[0]-C00C
274    V1C5:=1
275    FCR 3,1,NCAL=1
276    V1C6:=V1C6+LSLT[LSLSSL,1]  & SET END TIME OF THIS INTERVAL
277    ENDFCF
278    V1C16:=V216-L116
279    V1C14:=V214+2
280    V1C22:=#P
281    V1C24:=#
282    V1C25:=#
283    FCR 3,1,L1,1
284    J:=I+2
285    IF SECTET[J]=0
286      V225:=V225+SLCTTTE[J]-EGCS(1) & FOR ALL CPUS SUM
287      EGCS(J):=SLCTTTE[J] & SET TIME IN SYSTEM IDLE LOOP
288    ELSE
289      V225:=V225+INTVTH & THIS INTERVAL TIME IN SYSTEM IDLE LOOP
290      BGCS(I):=BGCS(I)+INTVTH & FOR ALL CPUS SUM
291    ENDIF
292    V224:=V224+SBCTCC[J]
293    J:=J+1
294    V221:=V224+SBCTCC[J]
295  ENDFUR
296    V223:=V223-L023
297    V124:=V224-S124
298    V225:=V225+E
299    MUTICS:=0
300    FCR M,2,2
301    MUTICS:=MUTICS+SFJUT[M]
302  ENDFOR
303  MUTICS:=(MUTICS-DEFILT)/1000
304  FCR M,2,7
305    I:=2+N
306    J:=I+1
307    SCALE SFMTCG[1],SFMTCG[J] & FOR EACH MAIN STORAGE CATEGORY
308    RESULT(1):=(SW-EFATCG(M))/MUTICS & GET DOUBLE WORD ENTRY AND
309    SCALE SFAVFG[1],SAVFG[J]
310    MPPROG(N):=(127+RESULT(M))/((SW-EFAPVG(M))/MUTICS)
311  ENDFOR
312    V127:=ARESULT(1)*c2
313    V128:=RESULT(1)*c4
314    V129:=RESULT(2)*c2
315    V130:=RESULT(2)*c4
316    V131:=RESULT(3)*c2
317    V132:=RESULT(3)*c4
318    V133:=RESULT(4)*c2
319    V134:=RESULT(4)*c4
320    V135:=RESULT(5)*c2
321    V136:=RESULT(5)*c4
322    V137:=RESULT(6)*c2
323    V138:=RESULT(6)*c4
324    V139:=NOFFOC(4)
325    V140:=NOFFOC(5)
326    V141:=NOFFOC(6)
327    V142:=NOFFOC(7)
328    V143:=NOFFOC(8)
329    V144:=NOFFOC(9)
330    V145:=NOFFOC(10)
331    V146:=NOFFOC(11)
332    V147:=NOFFOC(12)
333    V148:=NOFFOC(13)
334    V149:=NOFFOC(14)
335    V150:=NOFFOC(15)
336    V151:=NOFFOC(16)
337    V152:=NOFFOC(17)
338    V153:=NOFFOC(18)
339    V154:=NOFFOC(19)
340    V155:=NOFFOC(20)
341    V156:=NOFFOC(21)
342    V157:=NOFFOC(22)
343    V158:=NOFFOC(23)
344    V159:=NOFFOC(24)
345    V160:=NOFFOC(25)
346    V161:=NOFFOC(26)
347    V162:=NOFFOC(27)
348    V163:=NOFFOC(28)
349    V164:=NOFFOC(29)
350    V165:=NOFFOC(30)
351    V166:=NOFFOC(31)
352    V167:=NOFFOC(32)
353    V168:=NOFFOC(33)
354    V169:=NOFFOC(34)
355    V170:=NOFFOC(35)
356    V171:=NOFFOC(36)
357    V172:=NOFFOC(37)
358    V173:=NOFFOC(38)
359    V174:=NOFFOC(39)
360    V175:=NOFFOC(40)
361    V176:=NOFFOC(41)
362    V177:=NOFFOC(42)
363    V178:=NOFFOC(43)
364    V179:=NOFFOC(44)
365    V180:=NOFFOC(45)
366    V181:=NOFFOC(46)
367    V182:=NOFFOC(47)
368    V183:=NOFFOC(48)
369    V184:=NOFFOC(49)
370    V185:=NOFFOC(50)
371    V186:=NOFFOC(51)
372    V187:=NOFFOC(52)
373    V188:=NOFFOC(53)
374    V189:=NOFFOC(54)
375    V190:=NOFFOC(55)
376    V191:=NOFFOC(56)
377    V192:=NOFFOC(57)
378    V193:=NOFFOC(58)
379    V194:=NOFFOC(59)
380    V195:=NOFFOC(60)
381    V196:=NOFFOC(61)
382    V197:=NOFFOC(62)
383    V198:=NOFFOC(63)
384    V199:=NOFFOC(64)
385    V200:=NOFFOC(65)
386    V201:=NOFFOC(66)
387    V202:=NOFFOC(67)
388    V203:=NOFFOC(68)
389    V204:=NOFFOC(69)
390    V205:=NOFFOC(70)
391    V206:=NOFFOC(71)
392    V207:=NOFFOC(72)
393    V208:=NOFFOC(73)
394    V209:=NOFFOC(74)
395    V210:=NOFFOC(75)
396    V211:=NOFFOC(76)
397    V212:=NOFFOC(77)
398    V213:=NOFFOC(78)
399    V214:=NOFFOC(79)
400    V215:=NOFFOC(80)
401    V216:=NOFFOC(81)
402    V217:=NOFFOC(82)
403    V218:=NOFFOC(83)
404    V219:=NOFFOC(84)
405    V220:=NOFFOC(85)
406    V221:=NOFFOC(86)
407    V222:=NOFFOC(87)
408    V223:=NOFFOC(88)
409    V224:=NOFFOC(89)
410    V225:=NOFFOC(90)
411    V226:=NOFFOC(91)
412    V227:=NOFFOC(92)
413    V228:=NOFFOC(93)
414    V229:=NOFFOC(94)
415    V230:=NOFFOC(95)
416    V231:=NOFFOC(96)
417    V232:=NOFFOC(97)
418    V233:=NOFFOC(98)
419    V234:=NOFFOC(99)
420    V235:=NOFFOC(100)
421    V236:=NOFFOC(101)
422    V237:=NOFFOC(102)
423    V238:=NOFFOC(103)
424    V239:=NOFFOC(104)
425    V240:=NOFFOC(105)
426    V241:=NOFFOC(106)
427    V242:=NOFFOC(107)
428    V243:=NOFFOC(108)
429    V244:=NOFFOC(109)
430    V245:=NOFFOC(110)
431    V246:=NOFFOC(111)
432    V247:=NOFFOC(112)
433    V248:=NOFFOC(113)
434    V249:=NOFFOC(114)
435    V250:=NOFFOC(115)
436    V251:=NOFFOC(116)
437    V252:=NOFFOC(117)
438    V253:=NOFFOC(118)
439    V254:=NOFFOC(119)
440    V255:=NOFFOC(120)
441    V256:=NOFFOC(121)
442    V257:=NOFFOC(122)
443    V258:=NOFFOC(123)
444    V259:=NOFFOC(124)
445    V260:=NOFFOC(125)
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416      RTIV
417      LNC
418      FUNCT RTIV
419      IF PLAL=1
420          ACTCAU:=1CAU
421          ACTIOU:=1IOU
422          FOR I,1..NLOCAL-1
423              IF PLIC(I)<=
424                  ACTCAU:=ACTCAU+1
425              ENDIF
426          ENDFOR
427          FOR I,1..NIOU-1
428              J:=1L011(I)+1L012(I)+1L015(I)+1L017(I)+1L009(I)+;
429              J:=J+1L011(I)+1L012(I)+1L015(I)
430              IF J<=
431                  ACTIOU:=ACTIOU-1
432              ENDIF
433          ENDFOR
434          F LOCAL,SCATE[!D6],INTVAG[!D4],*C105C000*,WEWKDATE[!F6],INTLEN[!D4],;
435          IMEP[!D5],ACTCAU[!D3],ACTIOU[!D3],NLG[!D3],HGU[!D3],;
436          NUNITS[!D3],EXECVERS[!C1F]
437          FLAG:=1
438      ENDIF
439      OID:=D001
440      P LOCAL,SPATL[!Dc],INTVNO[!D4],O10E[!D5],LASTIM[!D11],CURRIM[!D11]
441      O10:=O10+1
442      P LOCAL,SCATE[!D62],INTVNO[!D4],C10E[!D8],V001[!D11],V004[!D11],V016[!D11],;
443          V122[!D11],V024[!D11],V025[!D11],V030[!D11],V031[!D11],V072C[!D11]
444      OID:=O10+1
445      P LOCAL,SCATE[!D63],INTVNO[!D4],C10E[!D8],V033[!D11],V034[!D11],;
446          V135[!D11],V036[!D11],V037[!D11],V044C[!D11]
447      OID:=O10+1
448      P LOCAL,SCATE[!D6],INTVNO[!D4],O10E[!D8],V038[!D11],V039[!D11],;
449          V040C[!D11],V041[!D11],V042[!D11]
450      FOR I,1..NCAU-1
451          IF PI[1](I)>0
452              G10:=3CC00C11+(I+100)
453              P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],PC1[!D11],PC2[!D11],;
454                  PC12[!D11],PC17[!D11],PC18[!D11],PC19[!D11],PC20[!D11],;
455                  PC22[!D11],PC23[!D11]
456          ENDIF
457      ENDFOR
458      FOR I,1..NIOU-1
459          J:=1L001(I)+1L003(I)+1L005(I)+1L007(I)+1L009(I)+;
460          J:=J+1L011(I)+1L013(I)+1L015(I)
461          IF J>
462              G10:=4CL10011+(I+100)
463              P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC01[!D11],IUC02[!D11],;
464                  IUC03[!D11],IUC04[!D11],IUC05[!D11],IUC06[!D11],;
465                  IUC07[!D11],IUC08[!D11],IUC09[!D11]
466          G10:=G10+1
467          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC10[!D11],IUC11[!D11],;
468                  IUC12[!D11],IUC13[!D11],IUC14[!D11],IUC15[!D11],;
469                  IUC16[!D11]
470          ENDIF
471      ENDFOR
472      FOR I,1..NUNITS-1
473          G10:=G10+1
474          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC17[!D11],IUC18[!D11],;
475                  IUC19[!D11],IUC20[!D11],IUC21[!D11],IUC22[!D11],;
476                  IUC23[!D11],IUC24[!D11],IUC25[!D11],IUC26[!D11],;
477                  IUC27[!D11],IUC28[!D11],IUC29[!D11],IUC30[!D11],;
478          G10:=G10+1
479          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC31[!D11],IUC32[!D11],;
480                  IUC33[!D11],IUC34[!D11],IUC35[!D11],IUC36[!D11],;
481                  IUC37[!D11],IUC38[!D11],IUC39[!D11],IUC40[!D11],;
482          G10:=G10+1
483          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC41[!D11],IUC42[!D11],;
484                  IUC43[!D11],IUC44[!D11],IUC45[!D11],IUC46[!D11],;
485                  IUC47[!D11],IUC48[!D11],IUC49[!D11],IUC50[!D11],;
486          G10:=G10+1
487          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC51[!D11],IUC52[!D11],;
488                  IUC53[!D11],IUC54[!D11],IUC55[!D11],IUC56[!D11],;
489                  IUC57[!D11],IUC58[!D11],IUC59[!D11],IUC60[!D11],;
490          G10:=G10+1
491          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC61[!D11],IUC62[!D11],;
492                  IUC63[!D11],IUC64[!D11],IUC65[!D11],IUC66[!D11],;
493                  IUC67[!D11],IUC68[!D11],IUC69[!D11],IUC70[!D11],;
494          G10:=G10+1
495          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC71[!D11],IUC72[!D11],;
496                  IUC73[!D11],IUC74[!D11],IUC75[!D11],IUC76[!D11],;
497                  IUC77[!D11],IUC78[!D11],IUC79[!D11],IUC80[!D11],;
498          G10:=G10+1
499          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC81[!D11],IUC82[!D11],;
500                  IUC83[!D11],IUC84[!D11],IUC85[!D11],IUC86[!D11],;
501                  IUC87[!D11],IUC88[!D11],IUC89[!D11],IUC90[!D11],;
502          G10:=G10+1
503          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC91[!D11],IUC92[!D11],;
504                  IUC93[!D11],IUC94[!D11],IUC95[!D11],IUC96[!D11],;
505                  IUC97[!D11],IUC98[!D11],IUC99[!D11],IUC100[!D11],;
506          G10:=G10+1
507          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC101[!D11],IUC102[!D11],;
508                  IUC103[!D11],IUC104[!D11],IUC105[!D11],IUC106[!D11],;
509                  IUC107[!D11],IUC108[!D11],IUC109[!D11],IUC110[!D11],;
510          G10:=G10+1
511          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC111[!D11],IUC112[!D11],;
512                  IUC113[!D11],IUC114[!D11],IUC115[!D11],IUC116[!D11],;
513          G10:=G10+1
514          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC117[!D11],IUC118[!D11],;
515                  IUC119[!D11],IUC120[!D11],IUC121[!D11],IUC122[!D11],;
516                  IUC123[!D11],IUC124[!D11],IUC125[!D11],IUC126[!D11],;
517          G10:=G10+1
518          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC127[!D11],IUC128[!D11],;
519                  IUC129[!D11],IUC130[!D11],IUC131[!D11],IUC132[!D11],;
520          G10:=G10+1
521          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC133[!D11],IUC134[!D11],;
522                  IUC135[!D11],IUC136[!D11],IUC137[!D11],IUC138[!D11],;
523          G10:=G10+1
524          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC139[!D11],IUC140[!D11],;
525                  IUC141[!D11],IUC142[!D11],IUC143[!D11],IUC144[!D11],;
526          G10:=G10+1
527          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC145[!D11],IUC146[!D11],;
528                  IUC147[!D11],IUC148[!D11],IUC149[!D11],IUC150[!D11],;
529          G10:=G10+1
530          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC151[!D11],IUC152[!D11],;
531                  IUC153[!D11],IUC154[!D11],IUC155[!D11],IUC156[!D11],;
532          G10:=G10+1
533          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC157[!D11],IUC158[!D11],;
534                  IUC159[!D11],IUC160[!D11],IUC161[!D11],IUC162[!D11],;
535          G10:=G10+1
536          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC163[!D11],IUC164[!D11],;
537                  IUC165[!D11],IUC166[!D11],IUC167[!D11],IUC168[!D11],;
538          G10:=G10+1
539          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC169[!D11],IUC170[!D11],;
540                  IUC171[!D11],IUC172[!D11],IUC173[!D11],IUC174[!D11],;
541          G10:=G10+1
542          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC175[!D11],IUC176[!D11],;
543                  IUC177[!D11],IUC178[!D11],IUC179[!D11],IUC180[!D11],;
544          G10:=G10+1
545          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC181[!D11],IUC182[!D11],;
546                  IUC183[!D11],IUC184[!D11],IUC185[!D11],IUC186[!D11],;
547          G10:=G10+1
548          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC187[!D11],IUC188[!D11],;
549                  IUC189[!D11],IUC190[!D11],IUC191[!D11],IUC192[!D11],;
550          G10:=G10+1
551          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC193[!D11],IUC194[!D11],;
552                  IUC195[!D11],IUC196[!D11],IUC197[!D11],IUC198[!D11],;
553          G10:=G10+1
554          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC199[!D11],IUC200[!D11],;
555                  IUC201[!D11],IUC202[!D11],IUC203[!D11],IUC204[!D11],;
556          G10:=G10+1
557          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC205[!D11],IUC206[!D11],;
558                  IUC207[!D11],IUC208[!D11],IUC209[!D11],IUC210[!D11],;
559          G10:=G10+1
560          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC211[!D11],IUC212[!D11],;
561                  IUC213[!D11],IUC214[!D11],IUC215[!D11],IUC216[!D11],;
562          G10:=G10+1
563          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC217[!D11],IUC218[!D11],;
564                  IUC219[!D11],IUC220[!D11],IUC221[!D11],IUC222[!D11],;
565          G10:=G10+1
566          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC223[!D11],IUC224[!D11],;
567                  IUC225[!D11],IUC226[!D11],IUC227[!D11],IUC228[!D11],;
568          G10:=G10+1
569          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC229[!D11],IUC230[!D11],;
570                  IUC231[!D11],IUC232[!D11],IUC233[!D11],IUC234[!D11],;
571          G10:=G10+1
572          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC235[!D11],IUC236[!D11],;
573                  IUC237[!D11],IUC238[!D11],IUC239[!D11],IUC240[!D11],;
574          G10:=G10+1
575          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC241[!D11],IUC242[!D11],;
576                  IUC243[!D11],IUC244[!D11],IUC245[!D11],IUC246[!D11],;
577          G10:=G10+1
578          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC247[!D11],IUC248[!D11],;
579                  IUC249[!D11],IUC250[!D11],IUC251[!D11],IUC252[!D11],;
580          G10:=G10+1
581          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC253[!D11],IUC254[!D11],;
582                  IUC255[!D11],IUC256[!D11],IUC257[!D11],IUC258[!D11],;
583          G10:=G10+1
584          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC259[!D11],IUC260[!D11],;
585                  IUC261[!D11],IUC262[!D11],IUC263[!D11],IUC264[!D11],;
586          G10:=G10+1
587          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC265[!D11],IUC266[!D11],;
588                  IUC267[!D11],IUC268[!D11],IUC269[!D11],IUC270[!D11],;
589          G10:=G10+1
590          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC271[!D11],IUC272[!D11],;
591                  IUC273[!D11],IUC274[!D11],IUC275[!D11],IUC276[!D11],;
592          G10:=G10+1
593          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC277[!D11],IUC278[!D11],;
594                  IUC279[!D11],IUC280[!D11],IUC281[!D11],IUC282[!D11],;
595          G10:=G10+1
596          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC283[!D11],IUC284[!D11],;
597                  IUC285[!D11],IUC286[!D11],IUC287[!D11],IUC288[!D11],;
598          G10:=G10+1
599          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC289[!D11],IUC290[!D11],;
600                  IUC291[!D11],IUC292[!D11],IUC293[!D11],IUC294[!D11],;
601          G10:=G10+1
602          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC295[!D11],IUC296[!D11],;
603                  IUC297[!D11],IUC298[!D11],IUC299[!D11],IUC300[!D11],;
604          G10:=G10+1
605          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC301[!D11],IUC302[!D11],;
606                  IUC303[!D11],IUC304[!D11],IUC305[!D11],IUC306[!D11],;
607          G10:=G10+1
608          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC307[!D11],IUC308[!D11],;
609                  IUC309[!D11],IUC310[!D11],IUC311[!D11],IUC312[!D11],;
610          G10:=G10+1
611          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC313[!D11],IUC314[!D11],;
612                  IUC315[!D11],IUC316[!D11],IUC317[!D11],IUC318[!D11],;
613          G10:=G10+1
614          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC319[!D11],IUC320[!D11],;
615                  IUC321[!D11],IUC322[!D11],IUC323[!D11],IUC324[!D11],;
616          G10:=G10+1
617          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC325[!D11],IUC326[!D11],;
618                  IUC327[!D11],IUC328[!D11],IUC329[!D11],IUC330[!D11],;
619          G10:=G10+1
620          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC331[!D11],IUC332[!D11],;
621                  IUC333[!D11],IUC334[!D11],IUC335[!D11],IUC336[!D11],;
622          G10:=G10+1
623          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC337[!D11],IUC338[!D11],;
624                  IUC339[!D11],IUC340[!D11],IUC341[!D11],IUC342[!D11],;
625          G10:=G10+1
626          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC343[!D11],IUC344[!D11],;
627                  IUC345[!D11],IUC346[!D11],IUC347[!D11],IUC348[!D11],;
628          G10:=G10+1
629          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC349[!D11],IUC350[!D11],;
630                  IUC351[!D11],IUC352[!D11],IUC353[!D11],IUC354[!D11],;
631          G10:=G10+1
632          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC355[!D11],IUC356[!D11],;
633                  IUC357[!D11],IUC358[!D11],IUC359[!D11],IUC360[!D11],;
634          G10:=G10+1
635          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC361[!D11],IUC362[!D11],;
636                  IUC363[!D11],IUC364[!D11],IUC365[!D11],IUC366[!D11],;
637          G10:=G10+1
638          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC367[!D11],IUC368[!D11],;
639                  IUC369[!D11],IUC370[!D11],IUC371[!D11],IUC372[!D11],;
640          G10:=G10+1
641          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC373[!D11],IUC374[!D11],;
642                  IUC375[!D11],IUC376[!D11],IUC377[!D11],IUC378[!D11],;
643          G10:=G10+1
644          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC379[!D11],IUC380[!D11],;
645                  IUC381[!D11],IUC382[!D11],IUC383[!D11],IUC384[!D11],;
646          G10:=G10+1
647          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC385[!D11],IUC386[!D11],;
648                  IUC387[!D11],IUC388[!D11],IUC389[!D11],IUC390[!D11],;
649          G10:=G10+1
650          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC391[!D11],IUC392[!D11],;
651                  IUC393[!D11],IUC394[!D11],IUC395[!D11],IUC396[!D11],;
652          G10:=G10+1
653          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC397[!D11],IUC398[!D11],;
654                  IUC399[!D11],IUC400[!D11],IUC401[!D11],IUC402[!D11],;
655          G10:=G10+1
656          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC403[!D11],IUC404[!D11],;
657                  IUC405[!D11],IUC406[!D11],IUC407[!D11],IUC408[!D11],;
658          G10:=G10+1
659          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC409[!D11],IUC410[!D11],;
660                  IUC411[!D11],IUC412[!D11],IUC413[!D11],IUC414[!D11],;
661          G10:=G10+1
662          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC415[!D11],IUC416[!D11],;
663                  IUC417[!D11],IUC418[!D11],IUC419[!D11],IUC420[!D11],;
664          G10:=G10+1
665          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC421[!D11],IUC422[!D11],;
666                  IUC423[!D11],IUC424[!D11],IUC425[!D11],IUC426[!D11],;
667          G10:=G10+1
668          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC427[!D11],IUC428[!D11],;
669                  IUC429[!D11],IUC430[!D11],IUC431[!D11],IUC432[!D11],;
670          G10:=G10+1
671          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC433[!D11],IUC434[!D11],;
672                  IUC435[!D11],IUC436[!D11],IUC437[!D11],IUC438[!D11],;
673          G10:=G10+1
674          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC439[!D11],IUC440[!D11],;
675                  IUC441[!D11],IUC442[!D11],IUC443[!D11],IUC444[!D11],;
676          G10:=G10+1
677          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC445[!D11],IUC446[!D11],;
678                  IUC447[!D11],IUC448[!D11],IUC449[!D11],IUC450[!D11],;
679          G10:=G10+1
680          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC451[!D11],IUC452[!D11],;
681                  IUC453[!D11],IUC454[!D11],IUC455[!D11],IUC456[!D11],;
682          G10:=G10+1
683          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC457[!D11],IUC458[!D11],;
684                  IUC459[!D11],IUC460[!D11],IUC461[!D11],IUC462[!D11],;
685          G10:=G10+1
686          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC463[!D11],IUC464[!D11],;
687                  IUC465[!D11],IUC466[!D11],IUC467[!D11],IUC468[!D11],;
688          G10:=G10+1
689          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC469[!D11],IUC470[!D11],;
690                  IUC471[!D11],IUC472[!D11],IUC473[!D11],IUC474[!D11],;
691          G10:=G10+1
692          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC475[!D11],IUC476[!D11],;
693                  IUC477[!D11],IUC478[!D11],IUC479[!D11],IUC480[!D11],;
694          G10:=G10+1
695          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC481[!D11],IUC482[!D11],;
696                  IUC483[!D11],IUC484[!D11],IUC485[!D11],IUC486[!D11],;
697          G10:=G10+1
698          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC487[!D11],IUC488[!D11],;
699                  IUC489[!D11],IUC490[!D11],IUC491[!D11],IUC492[!D11],;
700          G10:=G10+1
701          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC493[!D11],IUC494[!D11],;
702                  IUC495[!D11],IUC496[!D11],IUC497[!D11],IUC498[!D11],;
703          G10:=G10+1
704          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC499[!D11],IUC500[!D11],;
705                  IUC501[!D11],IUC502[!D11],IUC503[!D11],IUC504[!D11],;
706          G10:=G10+1
707          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC505[!D11],IUC506[!D11],;
708                  IUC507[!D11],IUC508[!D11],IUC509[!D11],IUC510[!D11],;
709          G10:=G10+1
710          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC511[!D11],IUC512[!D11],;
711                  IUC513[!D11],IUC514[!D11],IUC515[!D11],IUC516[!D11],;
712          G10:=G10+1
713          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC517[!D11],IUC518[!D11],;
714                  IUC519[!D11],IUC520[!D11],IUC521[!D11],IUC522[!D11],;
715          G10:=G10+1
716          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC523[!D11],IUC524[!D11],;
717                  IUC525[!D11],IUC526[!D11],IUC527[!D11],IUC528[!D11],;
718          G10:=G10+1
719          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC529[!D11],IUC530[!D11],;
720                  IUC531[!D11],IUC532[!D11],IUC533[!D11],IUC534[!D11],;
721          G10:=G10+1
722          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC535[!D11],IUC536[!D11],;
723                  IUC537[!D11],IUC538[!D11],IUC539[!D11],IUC540[!D11],;
724          G10:=G10+1
725          P LOCAL,SCATE[!D63],INTVNCE[!D4],O10E[!D8],IUC541[!D11],IUC542[!D11],;
726                  IUC543[!D11],IUC544[!D11],IUC545[!D11],IUC546[!D11],;
727          G10:=G10
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ORIGINAL PAGE IS
OF POOR QUALITY

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S13    VILS#2,CC01*+01*10
S14    F LOCAL,SD/TEff[02],INTVNG[110-2],C1C[102],UTLC1[110111],UTCC2[110110],/
S15    UT[1110110],LTC7[110111],UTLG5[110110],UTCC3[110111],/
S16    LTC7[110111],LTC8[110110]
S17    ENDFOR
S18    .DC
S19    FUNCTSIZ[10]           /* SET FUNCTION SIZE TO ZERO
```

EFNTIC FILE CHMFRG

APPENDIX B

PROGRAM LISTING

PMS2*PMS.DRMFRU

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FMS100-F1.S1(),CRM.FPU

```

1   -----
2   C UNIT INVOCATION NAME: CRMFRU (DATA REDUCTION MODULE - FORTRAN,
3   C REDUCTION U.17)
4
5   C PURPOSE: TO CONVERT PAR REDUCED DATA TO FILES OF PERFORMANCE DATA
6   C FOR USE BY THE REMAINDER OF PMS.
7
8   C INVOCATION METHOD: EXEC PMS.CRMFRU
9
10  C FILE/RECORD REFERENCES:
11  C          FILE NAME           USE          CONTENTS
12  C          PMS>PARAMADEF.    I          DEFINITION OF PARAMETERS AND DEVICES
13  C          USED
14  C          PMS>OPERINPLT.    I          PMS OPERATOR INPUTS
15  C          PMS>IICOMFIGLU.    I          I/O CONFIGURATIONS
16  C          PMS>PARDATAFL.    I          PERFORMANCE DATA REDUCED BY PAR
17  C          PMS>SPHISTCH.    O          PERFORMANCE DATA OUTPUT FILE
18  C          PMS>TRACER.      O          PROGRAM EXECUTION MESSAGES
19  C          PMS>SYSCONFIG.   O          SYSTEM CONFIGURATION DATA
20
21  C INTERMEDIATE VARIABLES:
22  C          NAME        TYPE          DESCRIPTION
23  C          CNT         INT          ROW COUNTER FOR ARRAYS
24  C          NUMCDE     INT          NUMBER OF COE FILES IN PARAMFLNS.
25  C          FEFPUJ     REAL/COMMON  FEF MULTIPLIER FACTOR
26  C          FILCDB     INT          NUMBER OF COE FILES IN PARAMADEF.
27  C          DEVNAME    CHAR         DEVICE MNEMONIC FROM PARAMADEF.
28  C          UNIT        CHAR         DEVICE UNIT ID FROM PARAMADEF.
29  C          MODEL       CHAR         MODEL ID FROM PARAMADEF.
30  C          DATATYP    CHAR         DATA TYPE FROM PARAMADEF.
31  C          FARMSS     INT/COMMON  ONE DIMENSIONAL ARRAY OF 15 ELEMENTS
32  C          CONTAINING COE FILE NUMBERS FOR PARAMETERS
33  C          TWC         3-DIMEN.    TWO DIMENSIONAL ARRAY CONTAINING DEVICE
34  C          MNEMONIC, MODEL NO., UNIT NO, AND DATA TYPE
35  C          FOR ALL DEVICES IN PARAMADEF.
36  C          DEVDEF     CHAR/COMMON
37  C          DEVDAT     REAL/COMMON  TWO DIMENSIONAL DEVICE DATA ARRAY
38  C          NUDDEV    INT/COMMON  NUMBER OF DEVICES SPECIFIED IN PARAMADEF.
39  C          DAYCNT    INT          NUMBER OF CYCLES TO BE REDUCED IN ONE
40  C          INVOCAT    INT          INVOCATION OF CRMFRU, RECORD 5 OF MISCELLAN.
41  C          REFDAT     CHAR         REPORT DATE FROM OPERINPUT.
42  C          INDATE     REAL         DATES READ IN FROM OPERINPUT.
43  C          SSTATE     INT          START DATE OF REPORT
44  C          EDATE      INT          END DATE OF REPORT
45  C          DAYLCF    INT          MAIN LOOP COUNTER FOR DAYS OF SIF TO BE
46  C          REDUCED
47  C          JOCTYP     INT/COMMON  JOCONF1GU. RECORD TYPE
48  C          SAVDAT    INT/COMMON  SAVE DATE
49  C          FARTYP    INT/COMMON  RECORD TYPE FROM PARADATAFL.
50  C          LLDATE     INT/COMMON  SIF DATA LOGON DATE
51  C          INTVAL     INT/COMMON  INTERVAL NUMBER FROM PARADATAFL.
52  C          SUITYP    INT/COMMON  RECORD SUBTYPE FROM PARADATAFL.
53  C          NEXTDAY    CHAR/COMMON  NEXT DAY FOUND INDICATOR
54  C          ELFTIM     REAL/COMMON  ELAPSED TIME READ FROM PARADATAFL.
55  C          ERGCHN     INT/COMMON  ONE DIMENSIONAL ARRAY WITH 4 ELEMENTS
56  C          SPECIFYING ECCLESOR NUMBER IN USE

```

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17	L	INT/COMMON	MAIN MEMORY SIZE
18	C	PUFCPU	INT/COMMON
19	C	CALEVL	CHAR/COMMON
20	C	DEFCNT	INT/COMMON
21	C	TIMELD	INT/COMMON
22	C	TIMEOF	INT/COMMON
23	C	TIFCNT	INT/COMMON
24	C	SYSIDL	REAL/COMMON
25	C	REXRES	INT/COMMON
26	C	EXACPER	INT/COMMON
27	C	COMRES	INT/COMMON
28	C	TIFPER	INT/COMMON
29	C	FELPER	INT/COMMON
30	C	DEMPER	INT/COMMON
31	C	CATCHP	INT/COMMON
32	C	SIFCNT	INT/COMMON
33	C	TIFFPG	REAL/COMMON
34	C	STMPFG	REAL/COMMON
35	C	DEPFG	REAL/COMMON
36	C	BATCHP	REAL/COMMON
37	C	BLDATE	INT/COMMON
38	C	JCLE	REAL/COMMON
39	C	PRCIDL	REAL/COMMON
40	C	HSTARY	REAL/COMMON
41	C		ONE DIMENSIONAL ARRAY OF 12 ELEMENTS HOLDING DATA FOR SPHISTORY.
42	C		CREATION
43	C	ENDFIL	CHAR/COMMON
44	C	CPUCNT	INT/COMMON
45	C	CDENMA	INT/COMMON
46	C	EMCRST	CHAR/COMMON

DEVELOPMENT HISTORY

AUTHOR

REFERENCES

DESCRIPTION

R. AHOUR

INITIAL DRAFT 8/17/84

UNIT FLOW

```

-----+
***PROCESS 1** READ PARAMADEF FILE AND STORE DATA IN PARM'S UNTIL
EOF IS REACHED

RESET ROW COUNTER FOR ARRAYS, CNT, TO ZERO
RESET CDENMA TO ZERO
INITIALIZE ALL ELEMENTS OF PARM'S ARRAY TO ZEROS
INITIALIZE ALL ELEMENTS OF DEVDEF ARRAY TO BLANKS, " "
INITIALIZE ALL ELEMENTS OF DEVDAT ARRAY TO ZERO
OPEN PARAMADEF.
READ TWO FIELDS OF FIRST RECORD INTO NUMCDE, FLEPPUJ
((NOTE: ALL OF THE DATA TYPES BELOW MAY NOT BE USED IN ANY
PARTICULAR CONFIGURATION OF PARAMADEF.))
DO UNTIL EOF OF PARAMADEF
    FLAG FIVE FIELDS OF PRESENT RECORD OF PARAMADEF INTO FILCDE,
    DEVNAME, UNIT, MODEL, CATTYP
    ((NOW TEST DATA TYPE FOR PARAMETER WITH FILENAME FILE NO.))
    IF CATTYP IS "TIFWLF" ((TIP WORK LOAD, AVG JOBS IN MEMORY))
        THEN PARM'S(1) = FILCDE
    ENDIF
    IF CATTYP IS "DEMPER" ((DEMAND +CFK LOAD, AVG JOBS IN MEMORY))

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B-4

```
114 C THEN PARM'S(1) = FILCDE
115 L ENDIF
116 C IF LATTYP IS "WATLPL" ((WATCH WORK LOAD, AVG JOBS IN MEMORY))
117 C THEN PARM'S(1) = FILCOL
118 L ENDIF
119 C IF LATTYP IS "WCLALP" ((REAL TIME WORK LOAD, AVG JOBS IN MEMORY))
120 C THEN PARM'S(1) = FILCOL
121 L ENDIF
122 C IF CATTYP IS "WTIFRT" ((TIF RESPONSE TIME))
123 C THEN PARM'S(1) = FILCDE
124 L ENDIF
125 C IF LATTYP IS "WCRATP" ((COMMAND RESPONSE TIME))
126 C THEN PARM'S(1) = FILCDE
127 L ENDIF
128 C IF LATTYP IS "CPULP" ((CPU UTILIZATION))
129 C THEN PARM'S(1) = FILCDE
130 L ENDIF
131 C IF LATTYP IS "MEMULP" ((MEMORY UTILIZATION))
132 C THEN PARM'S(1) = FILCOL
133 L ENDIF
134 C IF CATTYP IS "SWFRT" ((SWF RATE))
135 C THEN PARM'S(1) = FILCDE
136 L ENDIF
137 C IF CATTYP IS "DIOULP" ((I/O CHANNEL UTILIZATION))
138 C THEN PARM'S(1) = FILCDE
139 L ENDIF
140 C ((CHECK TO SEE IF DATA TYPE REPRESENTED A DEVICE. IF SO,
141 C THEN PLACE READ RECORDS INTO THE DEVICE ARRAY))
142 C IF CATTYP WAS DISK UTILIZATION, "DSKUL", OR FEP WORK LOAD,
143 C "FEPWL", OR DTV WORK LOAD, "DTVWL", OR OTHER DEVICE WORK
144 C LOADS, "DEVWL"
145 C THEN
146 C     INCREMENT CNT BY ONE
147 C     SET DEVDEF(CNT,1) TO DEVNAME
148 C     SET DEVDEF(CNT,2) TO MODEL
149 C     SET DEVDEF(CNT,3) TO UNIT
150 C     SET DEVDEF(CNT,4) TO CATTYP
151 C     SET DEVDEF(CNT,5) TO FILCDE
152 C ENDIF
153 C IF LOFILE NO. IS GT MAIMUM FILE NUMBER THUS FAR
154 C THEN SET LOFILE NO. AS THE LARGEST FILE NUMBER READ FROM PARAMADEF
155 C ENDIF
156 C ENDDO
157 C SET NUMBER OF DEVICES, NUDEV, TO CNT
158 C CLOSE PARAMADEF.
159 C ***END PROCESS 1***
```

160 C
161 C
162 C
163 C ***PROCESS 2*** READ RECORDS OF MISCELLAN. FILE
164 C OPEN "MISCELLAN."
165 C ((EFFECTIVE OF THIS FILE CONTAINS THE NUMBER OF DAYS OF DATA))
166 C READ RECORD 5 OF "MISCELLAN." INTO DAYCNT
167 C CLOSE MISCELLAN.
168 C IF DAYCNT EQ 0
169 C THEN
170 C WRITE TO TERMINAL "DRFRU FINISHED - NO DATA REDUCED THIS LOOP"

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2100      READ (IN1,1-) FUM(CDE,FEPFL)
2101      IF (IN1,1-EER=925) FILCCL,DEVNNE,UNIT,MODEL,CATTYP
2102      TE=F1E(F+1
2103      IF (DATTYF,EG,"TIFAL") PARM5(1) = FILCCL
2104      IF (DATTYF,EG,"CMCLL") PARM5(2) = FILCDE
2105      IF (DATTYF,EG,"CATLL") PARM5(3) = FILCD
2106      IF (DATTYF,EG,"HELLL") PARM5(4) = FILCD
2107      IF (DATTYF,EG,"TIFRT") PARM5(5) = FILCCD
2108      IF (DATTYF,EG,"DMCRT") PARM5(6) = FILCDL
2109      IF (DATTYF,EG,"CPLLL") PARM5(7) = FILCDU
2110      IF (DATTYF,EG,"HEPLL") PARM5(8) = FILCDL
2111      IF (DATTYF,EG,"SWFR") PARM5(9) = FILCDL
2112      IF (DATTYF,EG,"DICLL") PARM5(10) = FILCCE
2113
2114      IF ((CATTYP,EG,"DSKUL"),OR,(CATTYP,EG,"FEPWL"),OR,
2115      L CATTYP,EG,"CTVAL"),OR,(CATTYP,EG,"DEVWL")) THE..
2116          CNT = (CNT + 1
2117          DEVDEF(CNT,1) = DEVNNE
2118          DEVDEF(CNT,2) = MODEL
2119          DEVDEF(CNT,3) = UNIT
2120          DEVDEF(CNT,4) = CATTYP
2121          DEVDAT(CNT,5) = FILCDE
2122      ENDIF
2123      IF (FILCCL,EG,29) THEN
2124          WRJTE(12,*)"PDP2 HAS SPECIFICATION."
2125          WRJTE(12,*)DEVLAT(CNT,1),DEVDAT(CNT,2),DEVDAT(CNT,3),
2126          DEVDAT(CNT,4),"
2127      ENDIF
2128      IF (FILCDL,GT,CDMAX) CDMAX = FILCCL
2129      IF (TEMP,NE,NUMCDE) GO TO 30
2130      NUMDEV = CNT
2131      WRITE(12,*)"TOTAL OF ",NUMDEV," DEVICES READ FROM PARAMDEF."
2132      CLOSE (IN1,EER=925)
2133      C ***END PROCESS 1 ***
2134
2135
2136      C ***PROCESS 2A*** READ RECORDS OF "MISCELLAN" FILE
2137      OPEN (IN1,EER=930,FILE="MISCELLAN.")
2138      READ (IN1,5) DAYCNT
2139      CLOSE (IN1,EER=930)
2140      WRITE(12,*)"NUMBER OF CYCLES TO BE REDUCED THIS LOOP: ",DAYCNT
2141      IF (DAYCNT,EO,0) GO TO 225
2142      C ***END PROCESS 2A ***
2143
2144
2145      C ***PROCESS 2B*** READ DATES FROM OPERINPUT. FILE
2146      OPEN (IN1,EER=941,FILE="OPERINPUT")
2147      READ (IN1,1) FEPDATE
2148      READ (IN1,7) INDATE
2149      STDATE = IFIX(INDATE*100 + 0.5)
2150      READ (IN1,7) INDATE
2151      EDDATE = IFIX(INDATE*100 + 0.5)
2152      CLOSE (IN1,EER=945)
2153      WRITE(12,*)"FEPDATE: ",FEPDATE,": START DATE: ",STDATE
2154      WRITE(12,*)"END DATE: ",EDDATE
2155
2156      C ***END PROCESS 2B ***

```

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140 C ***REFLCS 3*** REDUCE DATA FFCP INCCFILU AND PARENTAFL.
141 OPEN (111,ERR=951,FILE="PARENTAFL.")
142 OPEN (112,ERR=952,FILE="INCCFILU.")
143 OPEN (113,ERR=953,FILE="CPFIESTCFY.")
144 WRITE(111,*)"DRMFRL: OPENED FILES, READY TO REDUCE ",DAYCNT
145 WRITE(111,*)"CYCLES OF DATA."
146 READ (112,*,ERR=954,END=967) IUCTYF
147 IF (IUCTYF.NE.11) GO TO 90
148 DAYLOP=1;DAYNT
149 CALL DRMFRL
150 WRITE(111,*)"INCCFILU. FILE PROCESSED SUCCESSFULLY IN DRMFRL"
151 WRITE(111,*)"FOR CLOCK ",DAYLOP,"."
152 SAVDAT = ""
153 IF (DAYLOP.EQ.1) THEN
154   READ (111,127,ERR=970,END=977) ELKDAT,INTVAL,FARTYP,SUETYP
155   IF (FARTYP.NE.01) GO TO 115
156 ENDIF
157 SAVDAT = ELKDAT
158 NEXTD1 = "N"
159 ENDFIL = "N"
160 150 CALL DRMFRL2
161 IF ((ELPTIM.EQ.0,C).OP.(ELKDAT,LT,STCATE).OR.(ELKDAT,GT,EDDATE)
162 .OR.((ELKDAT,GT,(SAVDAT+1))) THEN
163   WRITE(111,*)"DRMFRL - PAR FILE NOT IN PROPER SEQUENCE OR
164   ELAPSED TIME OUT OF BOUNDS"
165   GO TO 9999
166 ELSE
167   CALL DRMFRL3
168   CALL DRMFRL4
169 ENDIF
170 IF ((NEXTD1.EQ."N"),AND.(ENDFIL.EQ."N")) GO TO 130
171 IF ((ENDFIL.EQ."Y"),AND.(DAYLOP.NE.DAYCNT)) GO TO 991
172 140 CONTINUE
173 OPEN (14,ERR=955,FILE="SYS CONFIG.")
174 WRITE(14,125) TOTMEM
175 WRITE(14,126) NUMCPU
176 WRITE(14,127) EXLEV
177 WRITE(14,128) DSKCAT
178 WRITE(14,*)"DRMFRL WRITE TO SYS CONFIG:"
179 WRITE(14,*)"TOTMEM: ",TOTMEM,", NUMCPU: ",NUMCPU
180 WRITE(14,*)"EXLEVEL: ",EXLEV,", DEKNT: ",DSKCAT,"."
181 CLOSE (14,ERR=997)
182 CLOSE (IN1,ERR=921)
183 CLOSE (IN2,ERR=955)
184 CLOSE (IN3,ERR=955)
185 WRITE(14,*)"DRMFRL: CLOSED OLD FILES"
186 C ***END PROCESS 3***

187 C
188 C TO 959
189 959 FORMAT ("***DRMFRL ERROR 4", A2)
190
191 955 WRITE(5,955) "995"
192 WRITE(5,*)"UNEXPECTED TERMINATION OF PARAMACF."
193 C TO 9999
194 951 WRITE (5,951) "91"
195 C TO 9999

```

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```

715  WRITE (6,11) "Y1"
716  GO TO 57722
717  WRITE (6,11) "920"
718  WRITE (6,11) "FAILURE TO READ PARAPACFL. FILE"
719  GO TO 99999
720  WRITE (6,11) "721"
721  GO TO 57722
722  WRITE (6,11) "93."
723  GO TO 99999
724  WRITE (6,11) "735"
725  GO TO 99999
726  WRITE (6,11) "74."
727  GO TO 99999
728  WRITE (6,11) "945"
729  GO TO 99999
730  WRITE (6,11) "95."
731  GO TO 99999
732  WRITE (6,11) "955"
733  GO TO 99999
734  WRITE (6,11) "965"
735  WRITE (6,11) "FAILURE TO READ IOCONFIGL. FILE"
736  GO TO 99999
737  WRITE (6,11) "967"
738  WRITE (6,11) "UNEXPECTED TERMINATION OF IOCONFIGL. FILE"
739  GO TO 99999
740  WRITE (6,11) "970"
741  WRITE (6,11) "FAILURE TO READ PARADATAFL. FILE"
742  GO TO 99999
743  WRITE (6,11) "971"
744  WRITE (6,11) "PARADATAFL. DOES NOT EXIST."
745  GO TO 99999
746  WRITE (6,11) "975"
747  GO TO 99999
748  WRITE (6,11) "980"
749  GO TO 99999
750  WRITE (6,11) "985"
751  GO TO 99999
752  WRITE (6,11) "990."
753  GO TO 99999
754  WRITE (6,11) "993"
755  WRITE (6,11) "UNEXPECTED TERMINATION OF PARADATAFL."
756  GO TO 99999
757  WRITE (6,11) "995"
758  GO TO 99999
759  WRITE (6,11) "997"
760  GO TO 99999
761  PRINT *, "CRMFRU FINISHED - NO DATA REDUCED THIS LOCF"
762  PRINT *, "*****SUCCESSFUL EXECUTION OF CRMFRU*****"
763  WRITE (*,*) "SUCCESSFUL EXECUTION OF CRMFRU"
764  CLOSE (11,ERR=575)
765  GO TO 99999
766  CALL FSETC (448)
767  WRITE (*,*) "CRMFRU EXECUTION HALTED"
768  STOP
769  END

```

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```

461      SUBROUTINE DRFFC1 (DATA REDUCTION MODULE - FORTRAN REDUCTION 1)
462
463      PURPOSE: TO PROCESS IOCONFIGU.
464          THIS MODULE READS IOCONFIGU, FOR ONE DAY TO BUILD PART OF
465          THE DEVDAT ARRAY.
466
467      INVOCATION PLSFCI: CALL PMS.DRFFC1
468
469      FILE/SCOPE REFERENCES:
470      FILE NAME           USE           DESCRIPTION
471      FMS-IOCONFIGU,       I           I/O CONFIGURATION FILE
472
473      LOCAL VARIABLES:
474      NAME                TYPE          DESCRIPTION
475      ICID                INT           UNIT NUMBER OF IOCONFIGU.
476      ICMEM               CHAR          DEVICE MONICK FROM IOCONFIGU.
477      ICOMUNIT             CHAR          I/O UNIT NUMBER
478      ICOMODL              CHAR          MODEL CODE FOR THE DEVICE
479      ICSTAT               INT           UP OR DOWN STATUS OF THE DEVICE
480      DEVFND              CHAR          DEVICE FOUND INDICATOR FLAG
481
482      UNIT FLOW
483
484
485      INITIALIZE IOCTYP TO ?
486      ((FIND NEXT HEADER RECORD OF IOCONFIGU., HAVING IOCTYP OF 1C))
487      DO UNTIL IOCTYP=1C OR EOF ((NORMAL EXITS)), OR ERROR CONDITION
488      READ IOCTYP FROM IOCONFIGU. ((FORMAT (12X,12) ))
489      IF IOCTYP = CE
490      THEN
491          ((RE-READ RECORD FROM BUFFER. THIS CAN BE DONE BY READING FROM
492          UNIT NUMBER ZERO))
493          READ FIELDS OF CURRENT RECORD OF IOCONFIGU. INTO ICID, ICMEM,
494          ICOMUNIT, ICOMODL, AND ICSTAT ((FORMAT (17X, 13, 19X, A3, ZA, A1,
495          A6, 5X, 11) ))
496          SET DEVICE FOUND INDICATOR, DEVFND, TO "N"
497          DO (FCR C,T=1 TO NUMBER OF DEVICES, NUMDEV) OR (UNTIL DEVFND="Y")
498          ((MATCH THE DEVICE IN IOCONFIGU. WITH THE DEVICE IN THE
499          DEVEDEF ARRAY. WHEN A MATCH IS FOUND, SAVE THE UP/DOWN STATUS
500          AND SET THE NEXT UNUSED DEVDAT ELEMENT TO THE UNIT NUMBER
501          READ FROM IOCONFIGU. ))
502          IF (DEVDEF(CNT,1) = ICMEM) AND (DEVDEF(CNT,2) = ICOMODL)
503          AND (DEVDEF(CNT,3) = ICOMUNIT)
504          THEN
505              SET UP/DOWN CODE IN DEVDAT(CNT,6) TO ICSTAT
506              SET DEVFND TO "Y"
507              ((SET THE SEVEN ALTERNATIVE DEVICE NUMBERS OF DEVDAT))
508              IF DEVICE NUMBER IN DEVDAT(CNT,1) HAS NOT YET BEEN SET,
509              STILL ","
510              THEN SET DEVDAT(CNT,1) TO ICID
511          ELSE
512              IF DEVDAT(CNT,7) = 1

```

```
517 THEN SET DEVDAT(CNT,3) TO 1010
518 ELSE
519   IF DEVDAT(CNT,3) =
520   THEN SET DEVDAT(CNT,3) TO 1010
521   ELSE
522     IF DEVDAT(CNT,4) =
523     THEN SET DEVDAT(CNT,4) TO 1010
524     ELSE
525       IF DEVDAT(CNT,12) =
526       THEN SET DEVDAT(CNT,12) TO 1010
527       ELSE
528         IF DEVDAT(CNT,14) =
529         THEN SET DEVDAT(CNT,14) TO 1010
530         ELSE
531           IF DEVDAT(CNT,15) =
532           THEN SET DEVDAT(CNT,15) TO 1010
533           ELSE SET DEVDAT(CNT,16) TO 1010
534         ENDIF ((FOR ALTERNATE #6))
535       ENDIF ((FOR ALTERNATE #5))
536     ENDIF ((FOR ALTERNATE #4))
537   ENDIF ((FOR ALTERNATE #3))
538 ENDIF ((FOR ALTERNATE #2))
539 ENDIF ((FOR ALTERNATE #1))
540 ENDIF ((FOR DEVICE NUMBER))
541
542 ENDCG
543
544 ENDIF
545
546 RETURN
547 -----
548 CCDE
549 -----
550
551 SUBROUTINE CRMFR1
552
553
554 **LOCAL DECLARATIONS**
555 INTEGER 101L,10STAT,CNT,IOCTYP
556 CHARACTER JMMEM*2,JOUNIT*1,JOGRCL*6,CEVFAC*1
557
558 **GLOBAL DECLARATIONS**
559 INTEGER SAVDAT,FARTYP,ELKCAT,INTVAL,CPUCNT,PPOCNM(4),TOTMEM
560 INTEGER TIMEON,TIMEOF,T1FCNT,REXMEM,EACHEN,COMMEN,TIPMEM,RELMEM
561 INTEGER NUMDEV,DEMMEF,BATMEM,SWPCNT,OLDATE,PARMS(15),CDUMAX
562 INTEGER NUMCPU,DSKCNT,IN,IN1,IN2,IN3
563 REAL FEPFUJ,ELFTIM,SYSJCL,TIPPRG,DEVLAT(99,16)
564 REAL RTMPRG,LNCPRC,CATPRG,PROJCL,HSTARV(102)
565 CHARACTER DEVDEF(55,4)*3,NEXTCY*1,EXLEVEL*12,ENDFL*1
566 COMMON FEPFUJ,FARMS,DEVCF,DEVDAT,NUMDEV,SAVDAT,CPUCNT,ENDFL
567 COMMON PARTYP,ELKCAT,INTVAL,NEXTCY,ELFTIM,PROGM,TOTMEM,DSKCNT
568 COMMON NUMCPU,LYLEV1,TIPECH,TIMEOF,TIPCNT,SYSJCL,REYMEM,EXCMEM
569 COMMON COMMEN,TIFYEN,ELKMEM,DEMMEF,BATMEM,SWPCNT,TIPPRG,RTMPRG
570 COMMON LMDPAC,DATAFL,ULLATE,PRCIDL,HSTARV,IN,IN1,IN2,IN3,CDUMAX
571 COMMON LMDPST
572
573 21: FURPAT(16),17)
574 22: FURPAT(17),17,19X,AL,2X,*1,AE,EX,11)
575
576 IOCTYP =
577 CL 25. CNT=1,NUMDEV
```

```
571      DEVDAT(CNT,1) = .0%
572      DEVDAT(CNT,2) = .0%
573      DEVDAT(CNT,3) = .0%
574      DEVDAT(CNT,4) = .0%
575      DEVDAT(CNT,5) = .0%
576      DEVDAT(CNT,6) = .0%
577      DEVDAT(CNT,7) = .0%
578      CONTINUE
579      READ(LIN1,C1,F,END=666,SHD=24") ICCTYP
580      IF ((ICCTYP,EG,C$) THEN
581          READ(L1,L2L) ICIL,ICMPLR,ICUNIT,ICROLL,ICSTAT
582          DEVFLG = "N"
583          DO 333 CNT=1,NLMDEV
584              IF (((DEVDEF(CNT,1),EG,ICM,EM),AND,(DEVDEF(CNT,2),EG,
585                  ICROLL),AND,(DEVDEF(CNT,3),EG,ICUNIT)) THEN
586                  LEVFDL(CNT,5) = 10STAT
587                  LEVFDL = 10
588                  IF (DEVDAT(CNT,1),EG,C,0) THEN
589                      DEVDAT(CNT,1) = 10ID
590                  ELSE
591                      IF (DEVDAT(CNT,2),EG,C,0) THEN
592                          DEVDAT(CNT,2) = 10ID
593                      ELSE
594                          IF (DEVDAT(CNT,3),EG,C,0) THEN
595                              CIVCAT(CNT,3) = 10ID
596                          ELSE
597                              IF (DEVDAT(CNT,4),EG,C,L) THEN
598                                  DEVDAT(CNT,4) = 10ID
599                              ELSE
600                                  IF (DEVDAT(CNT,12),EG,L,L) THEN
601                                      DEVDAT(CNT,12) = 10ID
602                                  ELSE
603                                      IF (DEVDAT(CNT,14),EG,C,C) THEN
604                                          DEVDAT(CNT,14) = 10ID
605                                      ELSE
606                                          IF (DEVDAT(CNT,15),EG,L,C) THEN
607                                              DEVDAT(CNT,15) = 10ID
608                                          ELSE
609                                              DEVDAT(CNT,16) = 1C1D
610                                          ENDIF
611                                      ENDCIF
612                                      ENDCIF
613                                      ENDCIF
614                                      ENDCIF
615                                      ENDCIF
616                                      ENDCIF
617                                      ENDCIF
618                                      IF (DEVFLG,EG,"Y") GO TO 333
619
620      CONTINUE
621      ENDIF
622      IF (ICCTYP,EG,"W") GO TO 110
623      PCTUFI,
624      CALL FSETC (44C)
625      STOP
626      END
```

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6.4 C      ENDIF
6.5 C      IF (PARTYP = 1) AND (SUETYP = 0)
6.6 C      THEN READ F/FCDT/FL. AGAIN, INTO: ELPTIM, TIPONT, SYSJCL, REXMEM,
6.7 C          CYCLES ((FORMAT (1'), F11.4, 1X, 1'1; 1X, F11.4, 49A, 11',
6.8 C          1X, 111))
6.9 C      ENDIF
6.10 C      IF (PARTYP = 1) AND (SUETYP = 1)
6.11 C      THEN READ F/FCDT/FL. AGAIN, INTO: COMMER, TIPMEM, RELMEM, DEMMEM,
6.12 C          LUTMEM, SWFCHT ((FORMAT (21X, 111; 1X, 111, 1X, 111; 1X, 111))
6.13 C      ENDIF
6.14 C      IF (PARTYP = 1) AND (SUETYP = 4)
6.15 C      THEN READ F/FCDT/FL. AGAIN, INTO: TIPPRC, RTMPRG, DMDFRG, BATPRG,
6.16 C          PRDRT
6.17 C          ((FORMAT ('IX, F11.4, 1A, F11.7, 1X, F11.2, 1X, F11.2, 1X, F11.2)))
6.18 C      ENDIF
6.19 C      IF PARTYP = 2
6.20 C      THEN
6.21 C          INCREMENT (PCLCNT BY 1
6.22 C          ((FOLLOWING READ DONE WITH FORMAT (1E, 11A, I3, 85X, F11.4) ))
6.23 C          READ F/FCDT/FL. AGAIN, INTO: BLDATE, PROCNM(PCLCAT), ICLE
6.24 C          ((UPDATE PROCESSOR IDLE TIME))
6.25 C          PRCIDL = PROIDL + ICLE
6.26 C      ENDIF
6.27 C      IF PARTYP = 5 ((A DEVICE))
6.28 C      THEN
6.29 C          ((FOLLOWING READ DONE WITH FORMAT (17X, J3, 1X, 111, 1X, 111,
6.30 C          25X, F11.4, 1X, F11.4, 1X, J11, 1X, 111)))
6.31 C          READ F/FCDT/FL. AGAIN, INTO: SCVEUN, SINRLJ, SOTREG, SCATTM,
6.32 C          SEXTIM, SFEGUD, SCUMSZ
6.33 C          ((CHECK TO FIND DEVICE UNIT NUMBER, SCVEUN, IN DEVDAT (DEVICE
6.34 C          NUMBER OF THE 7 ALTERNATIVE DEVICE NUMBERS))
6.35 C          DO FOR CNT=1 TO NUMBER OF DEVICES, NUMDEV
6.36 C              IF (CEVCAT(CNT,1) = SCVEUN)
6.37 C                  OR (DEVCAT(CNT,2) = SCVEUN)
6.38 C                  OR (DEVCAT(CNT,3) = SCVEUN)
6.39 C                  OR (DEVCAT(CNT,4) = SCVEUN)
6.40 C                  OR (DEVCAT(CNT,13) = SCVEUN)
6.41 C                  OR (DEVCAT(CNT,14) = SCVEUN)
6.42 C                  OR (DEVCAT(CNT,15) = SCVEUN)
6.43 C                  OR (DEVCAT(CNT,16) = SCVEUN)
6.44 C              THEN
6.45 C                  UPDATE TOTAL REQUESTS IN, DEVCAT(CNT,7) BY ADDING
6.46 C                  SINRLJ TO IT
6.47 C                  UPDATE TOTAL REQUESTS OUT, DEVCAT(CNT,8) BY ADDING
6.48 C                  SOTREG TO IT
6.49 C                  UPDATE CUMULATIVE QUEUE SIZE, DEVCAT(CNT,5), BY ADDING
6.50 C                  SCUMSZ TO IT
6.51 C                  UPDATE NO. OF REQUESTS QUEUED, DEVCAT(CNT,10), BY ADDING
6.52 C                  SFEGUD TO IT
6.53 C                  UPDATE EXISTENCE TIME, DEVCAT(CNT,11), BY ADDING
6.54 C                  SCATTM TO IT
6.55 C                  UPDATE DATA TRANSFER TIME, DEVCAT(CNT,12) BY ADDING
6.56 C                  SCATTM TO IT
6.57 C              ENDIF
6.58 C          ENDDO
6.59 C      ENDIF
6.60 C      READ NEWT F/FCDT/FL. RECORD INTO: ELRDAT, INTVAL, PARTYP, SUETYP
```

```

751      C ((FOPEN(16, 1A, 1A, 1X, 1Z, ZX, 1Z) ))
752      C ((IF WE SET TO ANOTHER HEADER IN PARDATAFL., ONE EAT OF DATA HAS
753      C BEEN PROCESSED))
754      C IF END OF PARDATAFL., SET ENDFIL FLAG TO "Y" AND EXIT (RETURN)
755      C IF PARTYP = 1
756      C THEN SET NEXTD1 TO "Y"
757      C ENDDU
758      C RETURN
759
760
761      C -----
762      C CCDE
763      C -----
764      C SUBROUTINE CRDR2 ,
765
766      C **LOCAL DECLARATIONS**
767      INTEGER GLCDINT, SDEVLN, SJNRREG, SOTREG, SKEWUD, SCUMSZ, CNT, COL, SUETYP
768      REAL SCATTI, SEXTIM, IDLE
769      C **GLOBAL DECLARATIONS**
770      INTEGER SAVDAT, PARTYP, BLKDAT, INTVAL, CPUCNT, PROCNM(4), TOTMEM
771      INTEGER TIMEON, TIMEOF, TIPCNT, REXMEM, EXCMEM, COMMEM, TIPMEM, RELMEM
772      INTEGER NUMDEV, DEMMEM, EAITEM, SWPCNT, BLDATE, PARM(15), CDEMMAX
773      INTEGER NUMCPU, DSKCNT, IN, IN1, IN2, IN3
774      REAL FEPFUJ, ELPTIM, SYSIDL, TIPPRG, DEVCAT(99,16)
775      REAL RTMPRG, LMDPRG, BATPRG, PROIDL, HSTARY(102)
776      CHARACTER DEVCEF(99,4)*6, NEXTD1*1, EXLEVEL*12, ENDFIL*1
777      COMMON FEPFUJ, PARM, DEVCEF, DEVDAT, NUMDEV, SAVDAT, CPUCNT, ENDFIL
778      COMMON PARTYP, BLKDAT, INTVAL, NEXTD1, ELPTIM, PROCNM, TOTMEM, DSKCNT
779      COMMON NUMCPU, EXLEVEL, TIMEON, TIMEOF, TIPCNT, SYSIDL, REXMEM, EXCMEM
780      COMMON COMMEM, TIPMEM, RELMEM, DEMMEM, BATMEM, SWPCNT, TIPPRG, RTMPRG
781      COMMON LMDPRG, BATPRG, BLDATE, PROIDL, HSTARY, IN, IN1, IN2, IN3, CDEMMAX
782      COMMON LMDRST
783
784      34C FORMAT(32),16,1X,1Z,17X,A12)
785      35C FORMAT(21X,111,1X,111)
786      36C FORMAT(21X,F11.4,1X,111,1X,F11.4,49X,111,1X,111)
787      37C FORMAT(21X,111,1X,111,1X,111,1X,111,1X,111,1X,111)
788      38C FORMAT(212,F11.2,1X,F11.2,1X,F11.2,1X,F11.2,1X,F11.2)
789      39C FORMAT(16,11X,15,85X,F11.4)
790      40C FORMAT(17),13,1X,111,1X,111,2SX,F11.4,1X,F11.4,1X,111,1X,111)
791      41C FORMAT(16,1X,14,1X,12,3X,13)
792
793      PARMNM(1) = "
794      PARMNM(2) = "
795      PARMNM(3) = "
796      PARMNM(4) = "
797      CPUCNT = "
798      PROIDL = "
799      GLCDINT = INTVAL
800      DO 120 CNT=1,NUMDEV
801        DO 110 COL=7,1_
802          DEVCAT(CNT, COL) = ",C
803        CONTINUE
804      120 CONTINUE
805      130 IF (PARTYP.EQ.21) THEN
806        READ(L,14L) TOTMEM, NUMCPU, EXLEVEL
807      ENDIF

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L55 C LOCAL VARIABLES:  
L56 C NAME      TYPE      DESCRIPTION  
L57 C TMEF      REAL      TIMEOF CONVERTED TO REAL NUMBER  
L58 C TMON      REAL      TIMEON CONVERTED TO REAL NUMBER  
L59 C DSTATM    REAL      TOTAL DISK TRANSFER TIME  
L60 C TCTREQ    REAL      TOTAL NUMBER OF REQUESTS  
L61 C DEVTIME  REAL      DEVICE TIME  
L62 C TQLGLN    REAL      TRUE QUEUE LENGTH  
L63 C TSLSR     REAL      TRUE SERVICE TIME  
L64 C DISKNT    INT/COMMON COUNTER OF DISKS UP  
L65  
E66 C UNIT FLCK  
E67 C-----  
E68 C  
E69 C INITIALIZE ALL ELEMENTS OF HSTARY ARRAY TO -1.C, SYMBOL OF MISSING DATA  
E70 C CONVERT TIMEON FROM SEC. TO HF. REPRESENTATION, RESULT IN TMON  
E71 C CONVERT TIMEOF FROM SEC. TO HF. REPRESENTATION, RESULT IN TMOF  
E72 C ((ADJUST FOR FAILURE TO RESET S1P AFTER 24 HOURS))  
E73 C SET HSTARY(1) TO TMON MINUS NUMBER OF HRS. PAST 24 HRS.  
E74 C SET HSTARY(2) TO TMOF MINUS NUMBER OF HRS. PAST 24 HRS.  
E75 C COMPUTE DATE OF THE DAY BEING PROCESSED IN THE FORM YYMM.DG FROM SAVDAT  
E76 C AND TMON AND SAVE IN HSTARY(2)  
E77 C ((HENCE FORTH ELEMENTS OF HSTARY ARRAY WILL BE REFERENCED AS THREE  
E78 C PLUS THE ARRAY COUNTER TO TAKE INTO ACCOUNT THE THREE ELEMENTS ALREADY  
E79 C CREATED))  
E80 C IF PARM(1) HAS BEEN SET TO A CDE FILE NO., NO LONGER EQ TO 0  
E81 C THEN COMPUTE TIP THRUPUT AS THE QUOTIENT OF TIP TRANSACTION COUNT,  
E82 C TIFCNT, AND ELAPSED TIME, ELPTIM, RESULT IN HSTARY(PARM(1)+3)  
E83 C ENDIF  
E84 C IF PARM(2) HAS BEEN SET TO A CDE FILE NO., NO LONGER EQ TO 0  
E85 C THEN SET HSTARY(PARM(2)+3) TO AVERAGE NUMBER OF DEMAND JOBS IN MEMORY,  
E86 C DMPPG  
E87 C ENDIF  
E88 C IF PARM(3) HAS BEEN SET TO A CDE FILE NO., NO LONGER EQ TO 0  
E89 C THEN SET HSTARY(PARM(3)+3) TO AVERAGE NUMBER OF BATCH PROGRAMS IN  
E90 C MEMORY, BATPPC  
E91 C EPC?F  
E92 C IF PARM(4) HAS BEEN SET TO A CDE FILE NO., NO LONGER EQ TO 0  
E93 C THEN SET HSTARY(PARM(4)+3) TO AVERAGE NUMBER OF REAL TIME PROGRAMS  
E94 C IN MEMORY, RTVPRG  
E95 C ENDIF  
E96 C IF PARM(5) HAS BEEN SET TO A CDE FILE NO., NO LONGER EQ TO 0  
E97 C THEN  
E98 C   ((MAKE SURE DIVISION BY ZERO DOES NOT HAPPEN))  
E99 C   IF TIFCNT NE ZERO  
E100 C     THEN COMPUTE TIP RESPONSE TIME AS (TIPPRG + ELPTIM) / TIFCNT,  
E101 C       RESULT IN HSTARY(PARM(5)+3)  
E102 C   ENDIF  
E103 C ENDIF  
E104 C IF PARM(6) HAS BEEN SET TO A CDE FILE NO., NO LONGER EQ TO 0  
E105 C THEN HSTARY(PARM(6)+3) = DMPPST (DEMAND RESPONSE TIME)  
E106 C ENDIF  
E107 C IF PARM(7) HAS BEEN SET TO A CDE FILE NO., NO LONGER EQ TO 0  
E108 C THEN COMPUTE CPU UTILIZATION AS 1.0 - (1-((SYSIDL+HPOIDL)/CPUCNT) /  
E109 C   ELPTIM), RESULT IN HSTARY(PARM(7)+3)  
E110 C ENDIF  
E111 C IF PARM(8) HAS BEEN SET TO A CDE FILE NO., NO LONGER EQ TO 0
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912 C THEN COMPUTE MEMORY UTILIZATION AS ".5*((FEXMEM+CEMEM+CMMEM+TRPMEM+
913 C +ELVEM+LEM+HEATMEM)/TLTMEM), RESULT IN HSTARY(PARMS(6)+3)
914 C ENDIF
915 C IF PARM(5) HAS BEEN SET TO A CEE FILE NO., NO LONGER EQ TO 0
916 C THEN COMPUTE THE SWAP RATE AS SWFCNT / ELPTIM, RESULT IN
917 C HSTARY(PARMS(5)+7)
918 C ENDIF
919 C IF PARM(1L) HAS BEEN SET TO A CEE FILE NO., NO LONGER EQ TO 0
920 C THEN
921 C     INITIALIZE TOTAL DISK TRANSFER TIME, DSKTRN, TO 0
922 C     INITIALIZE DISK COUNTER, DSKCNT, TO ZERO
923 C     ((CALCULATE TOTAL DISK TRANSFER TIME))
924 C DO FOR CNT=1 TO TOTAL NUMBER OF DEVICES, NUMDEV,
925 C     IF (DEVAEFT(CNT,4) IS "CSKUL") AND (ICSTAT,
926 C         DEVDAT(CNT,5), IS UP, EQ TO 1)
927 C     THEN
928 C         ADD TO DSKTRN THE NEW DATA TRANSFER TIME IN DEVDAT(CNT,12)
929 C         INCREMENT DISK COUNTER, DSKCNT, BY 1
930 C     ENDIF
931 C ENDDO
932 C COMPUTE I/C CHANNEL UTILIZATION AS (DSKTRN*.5*100) / ELPTIM, RESULT
933 C IN HSTARY(PARM(1)+3)
934 C ENDIF
935 C DO FOR CNT=1 TO NUMDEV
936 C     COMPUTE TOTAL NUMBER OF REQUESTS, TOTREQ, BY SUMMING INPUT REQUESTS,
937 C     DEVDAT(CNT,7), AND OUTPUT REQUESTS, DEVDAT(CNT,8)
938 C     ((COMPUTE DEVICE UTILIZATION/THRUPUT FOR DTV AND OTHER I/O DEVICES
939 C     UP))
940 C     IF (DEVCF(CNT,4) IS "DTV+L") OR (DEVCF(CNT,4) IS "DEVWL")
941 C         AND DEVDAT(CNT,6) IS UP, EQ TO 1
942 C     THEN COMPUTE DEVICE UTILIZATION/THRUPUT AS TOTREQ DIVIDED BY ELPTIM,
943 C     RESULT IN HSTARY(DEVDAT(CNT,5)+3)
944 C     ELSE CLEAR HSTARY(DEVDAT(CNT,5)+3)
945 C     ENDIF
946 C     ((COMPUTE DEVICE UTILIZATION/THRUPUT FOR FEP'S UP))
947 C     IF (DEVCF(CNT,4) IS "FEPWL")
948 C     THEN
949 C         IF (DEVDAT(CNT,6) IS UP, EQ TO 1)
950 C             THEN COMPUTE DEVICE UTIL. THRUPUT :=(TOTREQ*FEPFUJ) / ELPTIM,
951 C                 RESULT IN HSTARY(DEVDAT(CNT,5)+3)
952 C             ELSE CLEAR HSTARY(DEVDAT(CNT,5)+3)
953 C         ENDIF
954 C     ENDIF
955 C     ((COMPUTE DEVICE UTILIZATION/THRUPUT FOR DISKS UP))
956 C     IF DEVCF(CNT,4) IS "CSKUL"
957 C     THEN
958 C         IF DEVDAT(CNT,6) IS UP, EQ TO 1
959 C         THEN
960 C             COMPUTE DEVICE TIME, DEVTIM, AS SUM OF EXISTENCE TIME,
961 C             DEVDAT(CNT,11), AND DATA TRANSFER TIME, DEVDAT(CNT,12)
962 C             IF (TOTAL NUMBER OF REQUESTS, TOTREQ, NE 0) AND (NUMBER OF
963 C             REQUESTS QUEUED, DEVDAT(CNT,17), NE 0)
964 C             THEN CALCULATE TOTAL QUEUE LENGTH, TRQLEN, AS
965 C             1 + (DEVDAT(CNT,4)/(DEVDAT(CNT,12)-1))*(DEVDAT(CNT,1L)/TOTREQ)
966 C             ELSE LET TRQLEN TO 1 AS QUEUE IS EMPTY
967 C         ENDIF
968 C         IF TOTREQ NE 0

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575      THEN COMPUTE THE SERVICE TIME, TPLSER, AS DEVICE TIME, DEVTIM,
576      DIVIDED BY THE QUOTIENT OF TOTREQ AND TRUGLN
577      ELSE CLEAR TPLSER
578      ENDIF
579      COMPUTE DEVICE UTILIZATION/THROUGHPUT, HSTARY(LEVCAT(CNT,5)+1), AS
580      1 - (TOTREQ + THUSER) / ELFTIM
581      ELSE CLEAR HSTARY(LEVCAT(CNT,5)+1)
582      ENDIF
583      ENDIF
584      ENDCR
585      ENDCC
586      RETURN.
587
588      -----
589      CODE
590      -----
591      SUBROUTINE DEMFR3
592
593      **LOCAL DECLARATIONS**
594      INTEGER CNT,J
595      REAL    TMON,TMON1,DSKTRN,TCTREG,DEVTIM,TRUGLN,TRUSER
596
597      **GLOBAL DECLARATIONS**
598      INTEGER   SAVCAT,PARTYP,ELVCAT,INTVAL,CPUCNT,PROCNM(4),TOTMEM
599      INTEGER   TIMEON,TIMEOF,TIFCNT,REXMEM,EXCMEM,COMMER,TIPMEM,KELMEM
600      INTEGER   NUMDEV,DEMDEM,BATMEM,SWPCNT,BLDATE,PARME(15),CDEMAX
601      INTEGER   NUMCPU,DSKCNT,IN,IN1,IN2,IN3
602      REAL     FEPFUJ,ELFTIM,SYSIDL,TIPPG,DEVDAT(99,16)
603      REAL     RTMPRG,CMPPRG,BATPRG,BLDATE,PARCIDL,HSTARY(152)
604      CHARACTER F DEVDEF(59,4)*6,NEXTDLY*1,EXLEV*12,ENDFIL*1
605      COMMON   FEPFUJ,PARMS,DEVDEF,DEVDAT,NUMDEV,SAVCAT,CPUCNT,ENDFIL
606      COMMON   PARTYP,ELVCAT,INTVAL,NEXTDLY,ELFTIM,PROCNM,TOTMEM,DSKCNT
607      COMMON   NUMCPU,EXLEV1,TIMEON,TIMEOF,TIPCNT,SYSIDL,REXMEM,EXCMEM
608      COMMON   COMMER,TIPMEM,RELDEM,BATMEM,SWPCNT,TIPPG,RTMPRG
609      COMMON   CMPPRG,BATPRG,BLDATE,PARCIDL,HSTARY,IN,IN1,IN2,IN3,CDEMAX
610      COMMON   CMURST
611
612      DO 490 I=1,1*2
613          HSTARY(I) = -1.0
614
615      490  CONTINUE
616      TMON = (1.0*TIMEON) / 3600
617      TMOF = (1.0*TIMEOF) / 3600
618      HSTARY(1) = TMON - (IFIX(TMON/24.0) * 24.0)
619      HSTARY(2) = TMOF - (IFIX(TMOF/24.0) * 24.0)
620      HSTARY(3) = (SAVCAT * C.C1) + (IFIX(TMON / 24.0) * C.01) + C.005
621      IF (PARMS(1).NE.0) THEN
622          HSTARY(PARMS(1)+1) = TIPCNT / ELFTIM
623      ENDIF
624      IF (PARMS(2).NE.0) THEN
625          HSTARY(PARMS(2)+1) = CMPPRG
626      ENDIF
627      IF (PARMS(3).NE.0) THEN
628          HSTARY(PARMS(3)+1) = BATPRG
629      ENDIF
630      IF (PARMS(4).NE.0) THEN
631          HSTARY(PARMS(4)+1) = RTMPRG
632      ENDIF
633      IF (PARMS(5).NE.0) THEN

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1016 IF (T1FCNT.NE.1) THEN
1017   HSTARV(PARM(5)+3) = T1PPRC + ELFTIM / T1FCNT
1018 ENDIF
1019 ENDIF
1020 IF (PARMS(6).NE.0) THEN
1021   HSTARV(PARM(6)+3) = DMCRST
1022 ELSE
1023   IF (PARMS(7).NE.0) THEN
1024     HSTARV(PARM(7)+3) = 100 * (1 - ((SYSTOL+PROCL) / CPUCNT)
1025       / ELFTIM)
1026 ENDIF
1027 IF (PARMS(8).NE.0) THEN
1028   HSTARV(PARM(8)+3) = 100 * (REXMEM+EXCHMEM+COMMEM+TIPMEM+RELMEM+
1029     LEXMEM+DATMEM) / TCTMEM
1030 ENDIF
1031 IF (PARMS(9).NE.0) THEN
1032   HSTARV(PARM(9)+3) = SWFCNT / ELFTIM
1033 ENDIF
1034 IF (PARMS(10).NE.0) THEN
1035   DSKTRN = 0.0
1036   DSKCNT = 0
1037   DO 500 CNT=1,NUMDEV
1038     IF ((DEVDEF(CNT,4).EQ."DSKUL")
1039       .AND.(DEVDAT(CNT,6).EQ.0)) THEN
1040       DSKTRN = DSKTRN + DEVDAT(CNT,12)
1041       DSKCNT = DSKCNT + 1
1042     ENDIF
1043   CONTINUE
1044   HSTARV(PARM(10)+3) = DSKTRN * 0.5 * 100 / ELFTIM
1045 ENDIF
1046 DO 510 CNT=1,NUMDEV
1047   IF ((DEVDEF(CNT,4).EQ."CTVWL")
1048     .OR.(DEVDEF(CNT,4).EQ."DEVWL")) THEN
1049     IF (DEVDAT(CNT,6).EQ.0) THEN
1050       HSTARV(DEVDAT(CNT,5)+3) =
1051         (DEVDAT(CNT,7)+DEVDAT(CNT,8))/ELFTIM
1052     ELSE
1053       HSTARV(DEVDAT(CNT,5)+3) = 0.0
1054     ENDIF
1055   ENDIF
1056   IF (DEVDEF(CNT,4).EQ."FEPWL") THEN
1057     IF (DEVDAT(CNT,6).EQ.0) THEN
1058       HSTARV(DEVDAT(CNT,5)+3) = ((DEVDAT(CNT,7)+DEVDAT(CNT,8))
1059         * FEPFUI) / ELFTIM
1060     ELSE
1061       HSTARV(DEVDAT(CNT,5)+3) = 0.0
1062     ENDIF
1063   ENDIF
1064   IF (DEVDEF(CNT,4).EQ."DSKUL") THEN
1065     IF (DEVDAT(CNT,6).EQ.0) THEN
1066       TOTREG = DEVDAT(CNT,7) + DEVDAT(CNT,8)
1067       LEVTIM = DEVDAT(CNT,11) + DEVDAT(CNT,12)
1068       IF ((TOTREG.NE.0).AND.(DEVLAT(CNT,10).NE.0)) THEN
1069         THULN = 1 + (DEVDAT(CNT,9) / DEVDAT(CNT,11) - 1) *
1070           DEVDAT(CNT,13) / TOTREG
1071       ELSE
1072         THULN = 1.0
1073     ENDIF
1074   ENDIF
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1140 C THEN SET HSTARV(CNT) TO -1.00 TO REPRESENT MISSING DATA
1141 C ENDIF
1142 C ENDC
1143 C ((EFLIST HSTARV(2), THE DATE IN THE FORM YYYY,DD, INTO 3 INTEGER
1144 C VARIABLES))
1145 C SET ICPT1 TO THE INTEGER PART OF HSTARV(2)
1146 C SET MONTH TO MONTH REPRESENTATION OF IDATE
1147 C SET DAY TO DAY REPRESENTATION OF HSTARV(2)
1148 C SET YEAR TO YEAR REPRESENTATION OF HSTARV(2)
1149 C ((IF YEAR IS DIVISIBLE BY 4, IT IS A LEAP YEAR))
1150 C SET LEAP TO LEAP / 4.
1151 C SET REMAINDER, REM, TO REMAINDER PART OF LEAP
1152 C IF REM IS NOT ZERO, LOOKING AT A LEAP YEAR,
1153 C THEN RESET NUMBER OF DAYS OF FEED, CALNDR(2), TO 29
1154 C ENDC
1155 C IF (MONTH LIES IN THE RANGE OF VALID MONTH NUMBERS 1 THROUGH 12)
1156 C AND (DAY IS LT OF EQ TO THE NUMBER OF DAYS IN MONTH, CALNDR(*MONTH),
1157 C CORRECTED FOR EXTRA DAY IN FEBRUARY DURING LEAP YEARS)
1158 C THEN WRITE TO SPHISTOR1, RECORDS OF HSTARV(CNT), CNT=1 TO CDBMAX13
1159 C ENDF
1160 C RETURN
1161 C
1162 C
1163 C -----CCDE-----
1164 C -----
1165 C SUBROUTINE DFMFR4
1166 C
1167 C **LOCAL DECLARATIONS**
1168 C      REAL      LEAP,REM
1169 C      INTEGER   CNT, IDATE,MONTH,DAY,YEAR
1170 C      INTEGER   CALNDR(12)/31,28,31,28,31,28,31,30,31,30,31,31/
1171 C **GLOBAL DECLARATIONS**
1172 C      INTEGER   SAVDAT,PARTYP,ELKCAT,INTVAL,CPUCNT,PROCNM(4),TOTMEM
1173 C      INTEGER   TIMEON,TIMEUF,TIPCNT,REXMEM,EXCMEM,COMMEM,TIPMEM,RELMEM
1174 C      INTEGER   NUMDEV,LEMMEM,BATMEM,SWPCT,BLDATE,PARMS(15),CDBMAX
1175 C      INTEGER   NUMCPU,DSKCNT,IN,IN1,IN2,IN3
1176 C      REAL      FEFUJ,ELFTIM,SYSCL,TIPPRG,DEVDAT(99,16)
1177 C      REAL      RTMPRG,LKCPRC,BATPRG,PGCIDL,HSTARV(102)
1178 C      CHARACTER DEVDEF(55,4)*6,NEXTDY*1,EXLEV1*12,ENDFL*1
1179 C      COMMON   FEFUJ,PARMS,DEVCLF,DEVDAT,NUMDEV,SAVDAT,(PCUCNT,ENDFL
1180 C      COMMON   PARTYP,LLKDAT,INTVAL,NEXTDY,ELPTIM,PROCNM,TOTMEM,DSKCAT
1181 C      COMMON   NUMCPU,EXLEV1,TIPCHN,TIMEOF,TIPCNT,SYSCD,REXMEM,EXCMEM
1182 C      COMMON   COMMEN,TIPMEM,RELMMEM,DEMMEM,BATMEM,SWPCT,TIPPRG,RTMPRG
1183 C      COMMON   DMOPRG,BATPRG,BLDATE,PGCIDL,HSTARV,IN,IN1,IN2,IN3,CDBMAX
1184 C      COMMON   CDBRST
1185 C
1186 C      DC 73C CNT=1,(CDBMAX)+3
1187 C      IF (HSTARV(CNT).GT.7300.00) HSTARV(CNT) = -1.00
1188 C      CONTINUE
1189 C      IDATE = JFIX(HSTARV(2))
1190 C      MONTH = MOD(IDATE,100)
1191 C      DAY = JFIX((HSTARV(2)+0.001)*100) - (100*IDATE)
1192 C      YEAR = JFIX(IDATE/10000)
1193 C      LEAP = YEAR / 4.
1194 C      REM = LEAP - JFIX(LEAP)
1195 C      IF (REM.LT.0.001) CALNDR(2) = 28
1196 C      IF ((MONTH.GT.12).AND.(MONTH.LT.1))
```

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B-23

```
1117      F .AND.(S=1,LE,CALNCH(MONTH))) THEN
1118        IF ((CCEMAX+2),GT,18) THEN
1119          WRITE(IN3,711) (HSTARY(CNT),CNT+1,16)
1120        ELSE
1121          WRITE(IN3,711) (HSTARY(CNT),(CNT+1,CCEMAX+2))
1122        ENDIF
1123        IF ((CCBMAX+2),GT,22) THEN
1124          WRITE(IN3,711) (HSTARY(CNT),CNT+17,22)
1125        ELSE
1126          IF ((CDLMAX+2),GT,16) THEN
1127            WRITE(IN3,711) (HSTARY(CNT),CNT+17,CDLMAX+2)
1128          ENDIF
1129        ENDIF
1130        IF ((CCEMAX+2),GT,48) THEN
1131          WRITE(IN3,711) (HSTARY(CNT),CNT=53,48)
1132        ELSE
1133          IF ((CCBMAX+2),GT,32) THEN
1134            WRITE(IN3,711) (HSTARY(CNT),CNT=53,CCBMAX+2)
1135          ENDIF
1136        ENDIF
1137        IF ((CCBMAX+2),GT,64) THEN
1138          WRITE(IN3,711) (HSTARY(CNT),CNT=49,64)
1139        ELSE
1140          IF ((CDLMAX+2),GT,48) THEN
1141            WRITE(IN3,711) (HSTARY(CNT),CNT=49,CDLMAX+2)
1142          ENDIF
1143        ENDIF
1144        IF ((CCBMAX+2),GT,80) THEN
1145          WRITE(IN3,711) (HSTARY(CNT),CNT=65,80)
1146        ELSE
1147          IF ((CCBMAX+2),GT,64) THEN
1148            WRITE(IN3,711) (HSTARY(CNT),CNT=65,CCBMAX+2)
1149          ENDIF
1150        ENDIF
1151      ENDIF
1152      700 FORMAT(16(F7.4,1X))
1153      RETURN
1154    END
1155    C
1156    C
1157    C
1158    C
```

LFBT,S,FAS,CM"FE1

APPENDIX C

**SAMPLE REPORT
GENERATED BY PMS2**

TRANSMISSION AND DATA RELAY SATELLITE SYSTEM

PERFORMANCE MANAGEMENT SYSTEM

DISCUSSION LIST:

Mr. Isley/B20, 1
 Mr. Harshy/B20
 Mr. Tagle/B30
 Mr. Sprintzak/B50
 Mr. Brumberg/B70
 Mr. Laios/B20, 1
 Mr. Goodson/B20, 1
 Mr. Parker/B20, 1
 Mr. Packard/B23
 Mr. Butler/B23
 Mr. Grunby/B23
 Ms. Frazer/BEFC/TDRSS
 Mr. Gorenstein/CSC
 Mr. Burham/CSC
 Mr. Holcomb/MITRE
 Dr. Kelly/DataMetrics
 Dr. Cleaver/UL
 Dr. Shelter/UL

RELAYLINK CONTROL CENTER

MONTHLY REPORT

FMS GENERATOR:

RAMIN FAHOUR

F1-1	F1-2	F1-3	F1-4	F1-5	F1-6	F1-7	F1-8	F1-9	F1-10	F1-11	F1-12	F1-13	F1-14	F1-15	F1-16	F1-17	F1-18	F1-19	F1-20	F1-21	F1-22	F1-23	F1-24	F1-25	F1-26	F1-27	F1-28	F1-29	F1-30	F1-31	F1-32	F1-33	F1-34	F1-35	F1-36	F1-37	F1-38	F1-39	F1-40	F1-41	F1-42	F1-43	F1-44	F1-45	F1-46	F1-47	F1-48	F1-49	F1-50	F1-51	F1-52	F1-53	F1-54	F1-55	F1-56	F1-57	F1-58	F1-59	F1-60	F1-61	F1-62	F1-63	F1-64	F1-65	F1-66	F1-67	F1-68	F1-69	F1-70	F1-71	F1-72	F1-73	F1-74	F1-75	F1-76	F1-77	F1-78	F1-79	F1-80	F1-81	F1-82	F1-83	F1-84	F1-85	F1-86	F1-87	F1-88	F1-89	F1-90	F1-91	F1-92	F1-93	F1-94	F1-95	F1-96	F1-97	F1-98	F1-99	F1-100
------	------	------	------	------	------	------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

PERIOD: 08/06/84 TO 08/09/84

FMS DEVELOPER:

ELECTRICAL ENGINEERING DEPT.
 UNIVERSITY OF LOUISVILLE
 LOUISVILLE, KY 40292
 (502) 588-6289

REPORT DATE: 10/23/84

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** - Omitted reports.

TABLE 3-1 - PORTER DAY SUMMARY : ed/07/84

LINE NO	LINEOFF	TIP	TIP	MEI	HIGHEST	AVERAGE	PERIOD	PERIOD
(11)	(12)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
24.6.3	.02	.59	26.01	6.50	24.00	7.35	1.07	.14
-40.3	-53	-53	35.62	37.04	57.00	17.07	.23	.04
-1.3	-63	-62	64.66	54.00	55.00	16.32	.22	-.84
.63	1.1.3	-22	64.90	55.00	51.00	1.78	.36	-.85
1.1.3	1.6.3	-21	59.41	4.22	51.00	1.31	.38	-.85
1.6.3	2.1.3	-23	60.29	4.46	51.00	1.34	.37	-.85
2.1.3	2.6.3	-22	64.40	3.94	51.00	1.31	.27	-.89
2.6.3	3.1.3	-29	49.15	7.03	50.00	1.72	.59	-.67
3.1.3	3.6.3	-24	59.38	4.18	50.00	1.37	.32	-.99
3.6.3	4.1.3	-26	58.13	4.40	50.00	1.39	.30	-.87
4.1.3	4.6.3	-40	35.36	5.57	50.00	3.17	.39	-.94
4.6.3	5.1.3	-39	35.80	5.77	50.00	2.77	.09	1.13
5.1.3	5.6.3	-50	28.08	6.31	50.00	4.71	.90	1.14
5.6.3	6.1.3	-94	15.02	9.16	50.00	5.68	1.17	1.52
6.1.3	6.6.3	-26	6.65	16.21	49.00	11.63	2.11	-.10
6.6.3	7.1.3	7.12	8.74	14.19	50.00	5.11	1.14	4.54
7.1.3	7.6.3	1.37	11.41	12.49	51.00	2.07	.63	2.87
7.6.3	8.1.3	1.96	7.93	17.41	52.00	26.03	2.89	4.16
8.1.3	8.6.3	2.16	7.35	15.01	52.00	3.56	.67	4.68
8.6.3	9.1.3	2.42	6.59	17.71	52.00	7.71	1.40	2.13
9.1.3	9.6.3	2.70	5.57	20.39	51.00	14.27	2.22	-.18
9.6.3	10.1.3	2.24	6.48	19.28	50.00	25.10	3.09	5.85
10.1.3	10.6.3	1.49	10.09	13.88	51.00	4.35	.97	4.78
10.6.3	11.1.3	1.99	7.33	17.60	50.00	6.86	1.26	3.28
11.1.3	11.6.3	1.79	8.36	16.83	51.00	1.19	.80	4.05
11.6.3	12.1.3	1.71	9.34	14.52	51.00	3.05	.79	3.53
12.1.3	12.6.3	2.05	8.63	19.11	54.00	3.70	1.16	4.40
12.6.3	13.1.3	1.37	13.65	13.08	56.00	3.72	1.04	2.65
13.1.3	13.6.3	.55	34.50	5.67	56.00	2.63	.68	1.17
13.6.3	14.1.3	14.13	.56	34.73	5.61	56.00	3.64	2.22
14.1.3	14.6.3	.57	33.28	6.34	56.00	2.82	.87	1.12
14.6.3	15.1.3	.63	30.40	6.18	56.00	3.29	.85	1.08
15.1.3	15.6.3	.58	32.68	5.45	56.00	2.47	.61	1.06
15.6.3	16.1.3	.60	21.70	7.35	57.00	4.07	.94	1.09
16.1.3	16.6.3	.62	30.53	21.31	58.00	8.59	1.67	1.19
16.6.3	17.1.3	.64	29.81	16.87	58.00	7.69	1.80	1.35
17.1.3	17.6.3	.65	39.21	9.32	57.00	7.76	1.58	1.21
17.6.3	18.1.3	.55	36.54	11.30	57.00	3.20	.90	.67
18.1.3	18.6.3	.48	37.61	5.61	56.00	2.83	.56	1.03
18.6.3	19.1.3	.46	39.45	5.06	56.00	3.20	.62	1.16
19.1.3	19.6.3	.45	41.98	4.98	57.00	1.93	.42	.98
19.6.3	20.1.3	.42	45.67	4.54	57.00	1.61	.30	.63
20.1.3	20.6.3	.52	33.68	10.12	58.00	9.45	1.18	.85
20.6.3	21.1.3	.52	36.54	11.30	57.00	3.20	.23	1.03
21.1.3	21.6.3	.48	32.62	6.83	56.00	2.83	.22	.08
21.6.3	22.1.3	.51	35.43	5.03	55.00	1.91	.44	1.16
22.1.3	22.6.3	.42	40.56	4.54	54.00	1.89	.34	.99
22.6.3	23.1.3	.44	39.92	4.50	54.00	1.90	.31	1.00
23.1.3	23.6.3	.51	32.93	5.08	54.00	2.03	.49	1.07
23.6.3	23.13	.54	31.21	5.54	54.00	.57	.62	1.07

***** DENOTES DATA NOT AVAILABLE TO PMS

2...12: SEE SECTION 5 FOR EXPLANATION

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DRAFT - HOLDING REPORT

ENTRY OF SERIAL	TYPE NUMBER (2)	TYPE NUMBER (3)	RESPIR. (4)	TEST UTIL. (5)	TEST UTIL. (5)	HIGHEST TEST UTIL. (6)	AVERAGE TEST UTIL. (7)	HIGHEST TEST UTIL. (8)	AVERAGE TEST UTIL. (9)	DIV THRESH. (10)
84003-001#	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00
84004-07	-69	30.67*	10.65*	53.39*	5.22	1.01	.27	.13	1.89*	
84004-08	-44	71.84*	5.57*	44.29*	3.47	.61	.25	.11	1.59*	
84003-001#	.90	6.55*	17.35*	41.00*	≥0.73	.22	.15	.12	.71*	

* INDICATES ENTRY WITH LESS THAN 40 SIP BLOCKS OF DATA

INDICATES THRESHOLD EXCEEDED ENTRIES

-1...10: SEE SECTION 5 FOR EXPLANATION OF ENTRIES

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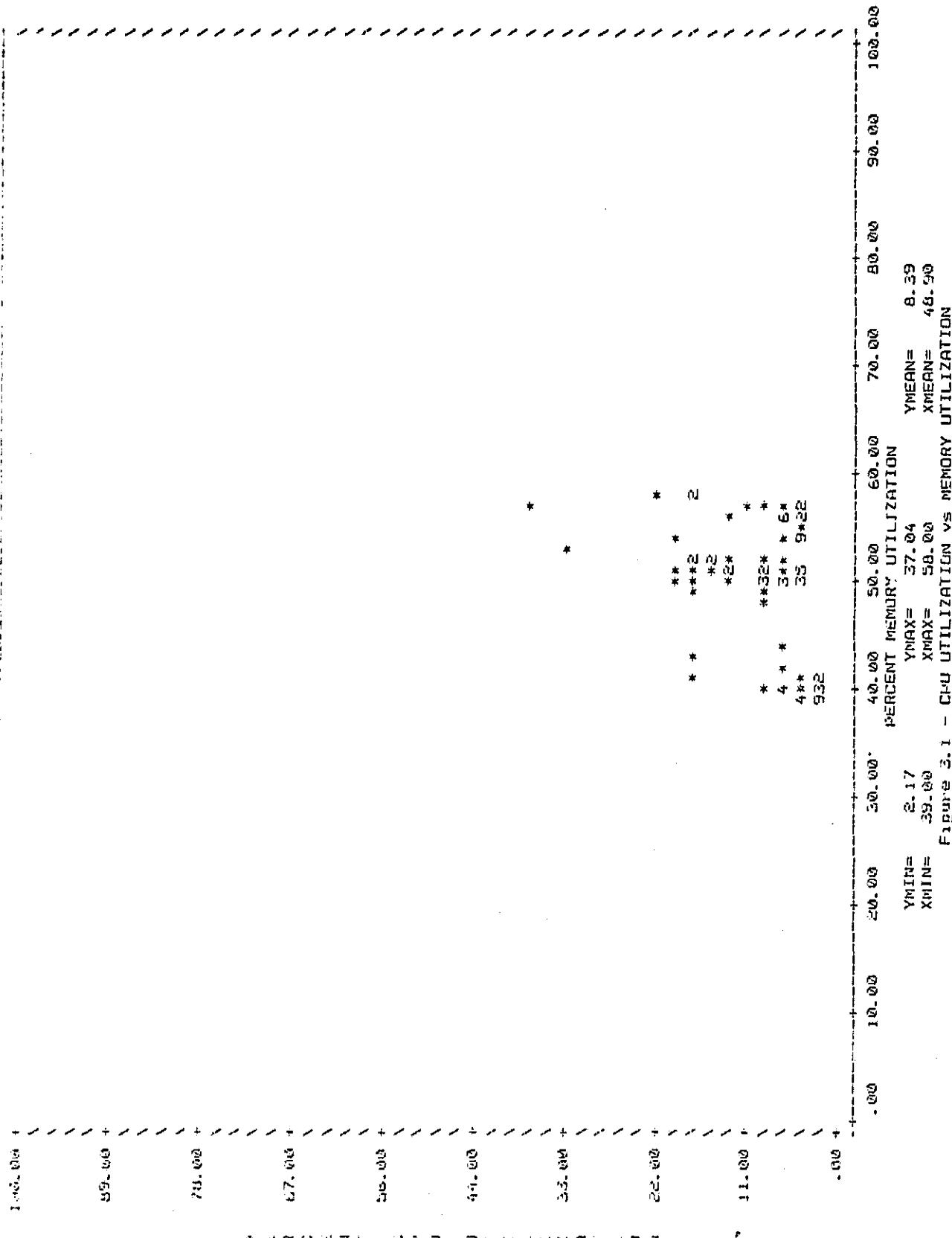


Figure 3.1 - CPU UTILIZATION VS MEMORY UTILIZATION

Test. Dat

03.00

74.00

E R C E N T G P U

54.00

44.00

*

*

*

*

00

10.00

20.00

30.00

40.00

50.00

60.00

70.00

80.00

90.00

100.00

YMIN= 2.17 YMAX= 37.04 YMEAN= 8.39
 XMIN= .84 XMAX= 26.03 XMEAN= 4.54

Figure 3.2 - CPU UTILIZATION VS HIGHEST DISK UTILIZATION

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E9.00

H I G H E S T D I S K U T I L I Z A T I O N

56.00

44.00

32.00

20.00

8.00

0.00

YMIN= 04 YMAX= 26.03 YMEAN= 4.54
XMIN= 39.00 XMAX= 58.00 XMEAN= 48.90
Figure 3.3 - HIGHEST DISK UTILIZATION vs MEMORY UTILIZATION

PERCENT MEMORY UTILIZATION

PERCENT MEMORY UTILIZATION	DISK UTILIZATION
50.00	60.00
40.00	50.00
30.00	40.00
20.00	30.00
10.00	20.00
0.00	10.00

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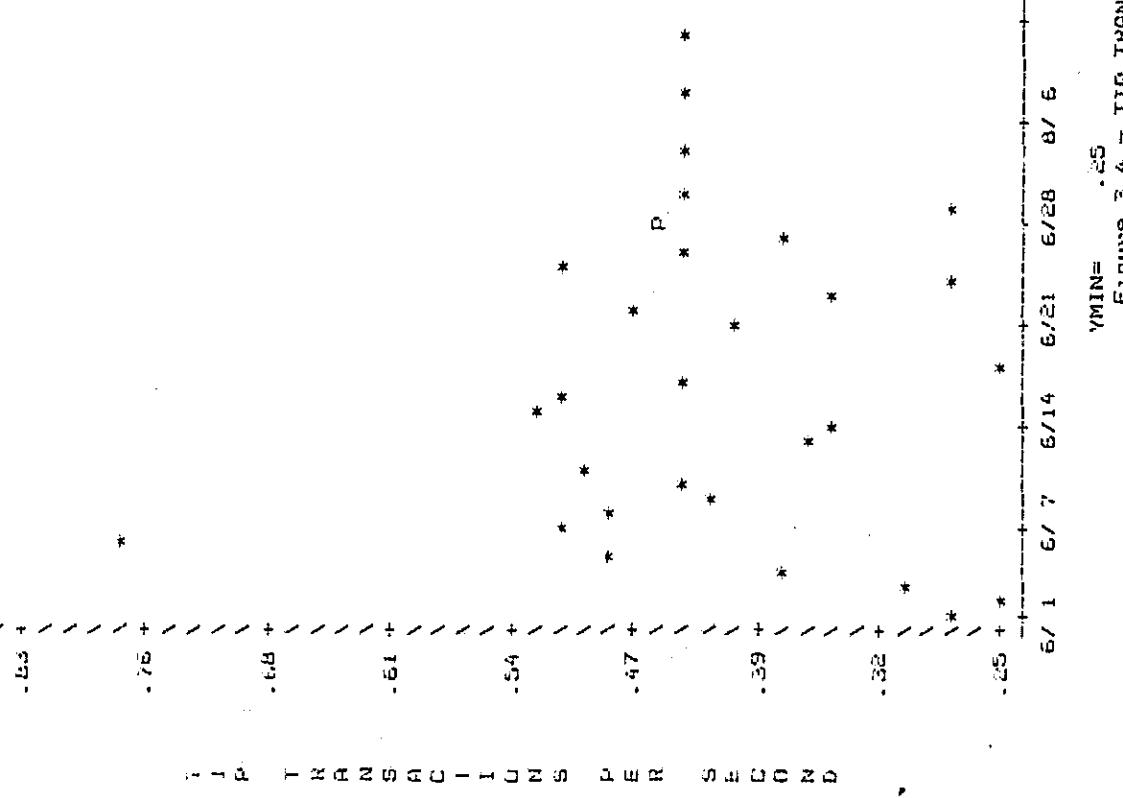


Figure 3.4 - TIP TRANSACTIONS PER SECOND vs DAY OF MONTH
YMIN= -25 YMAX= 75 YMEAN= 50

C-10

05.00

75.00

100.00

125.00

150.00

175.00

200.00

225.00

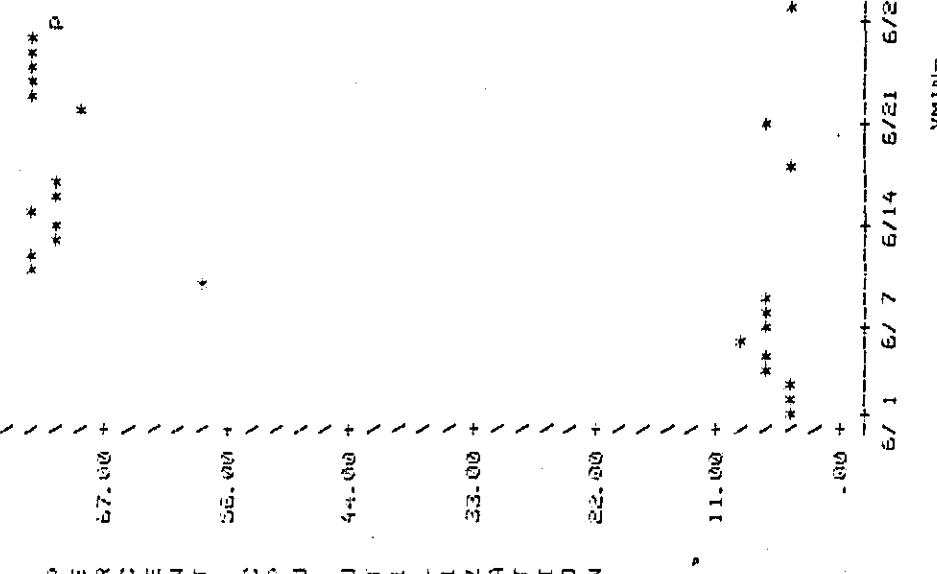
250.00

275.00

300.00

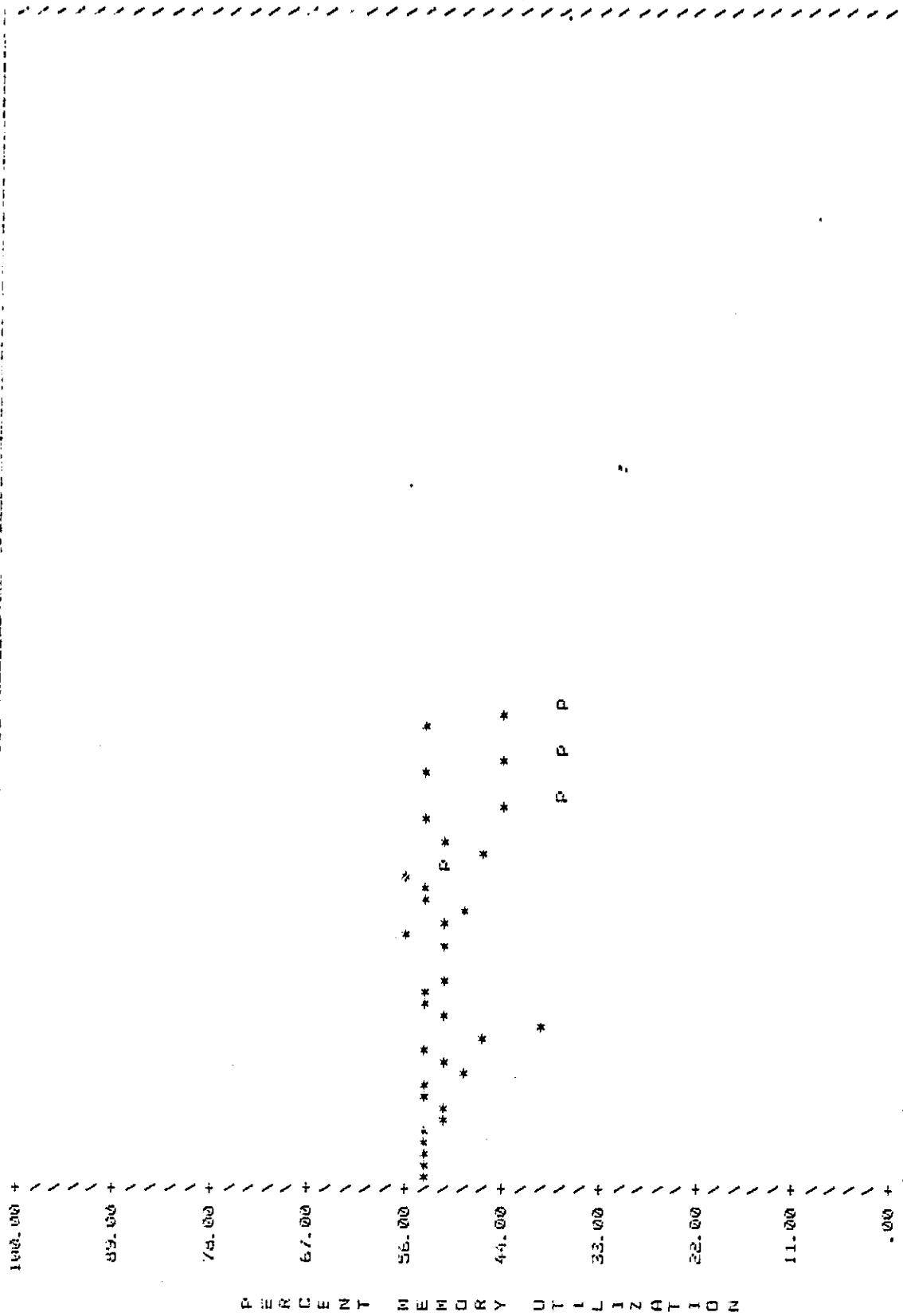
325.00

350.00



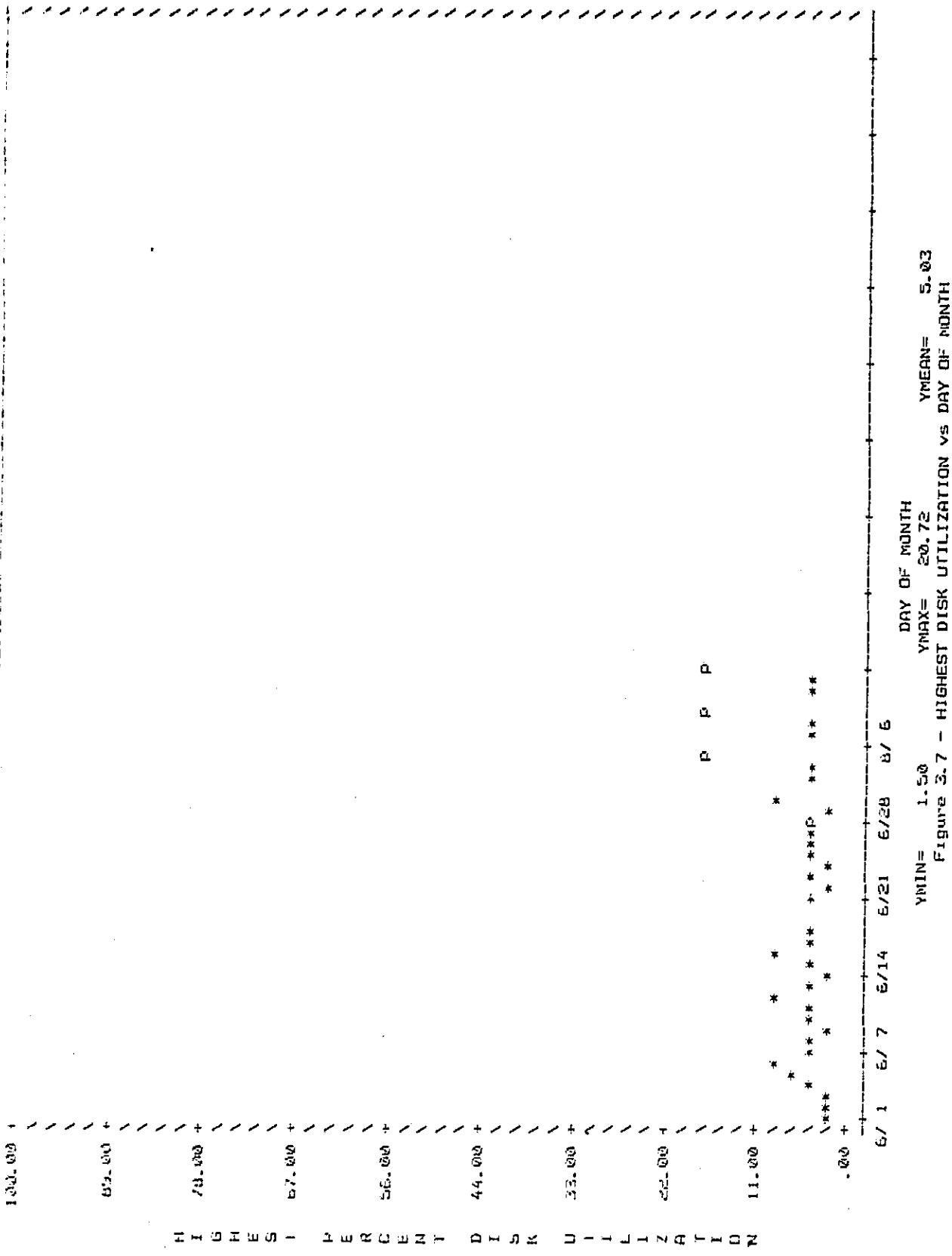
YMIN= 4-66 YMAX= 73-21 YMEAN= 29-82
Figure 3.5 - CPU UTILIZATION VS DAY OF MONTH

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YMIN= 40.90 YMAX= 54.71 YMEAN= 44.33
 Figure 3.6 - MEMORY UTILIZATION vs DAY OF MONTH

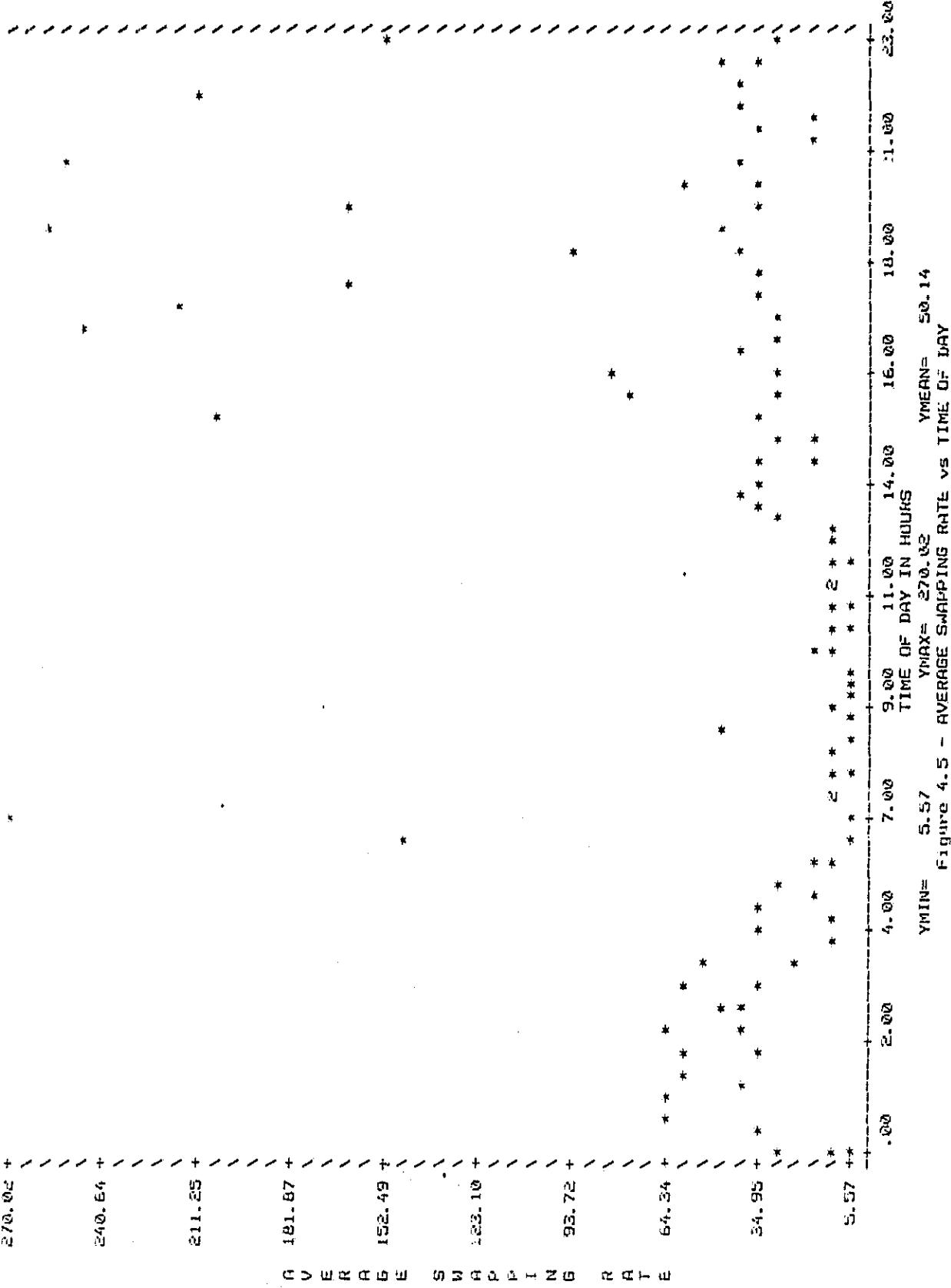
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YMIN= 1.50 YMAX= 20.72 YMEAN= 5.03
Figure 3.7 - HIGHEST DISK UTILIZATION VS DAY OF MONTH

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YMIN= 2.17 YMAX= 37.04 YMEAN= 8.39 TIME OF DAY IN HOURS

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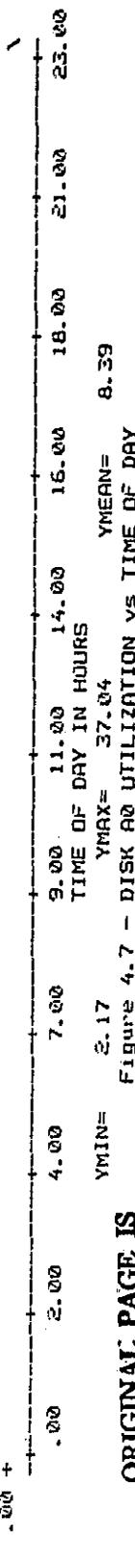
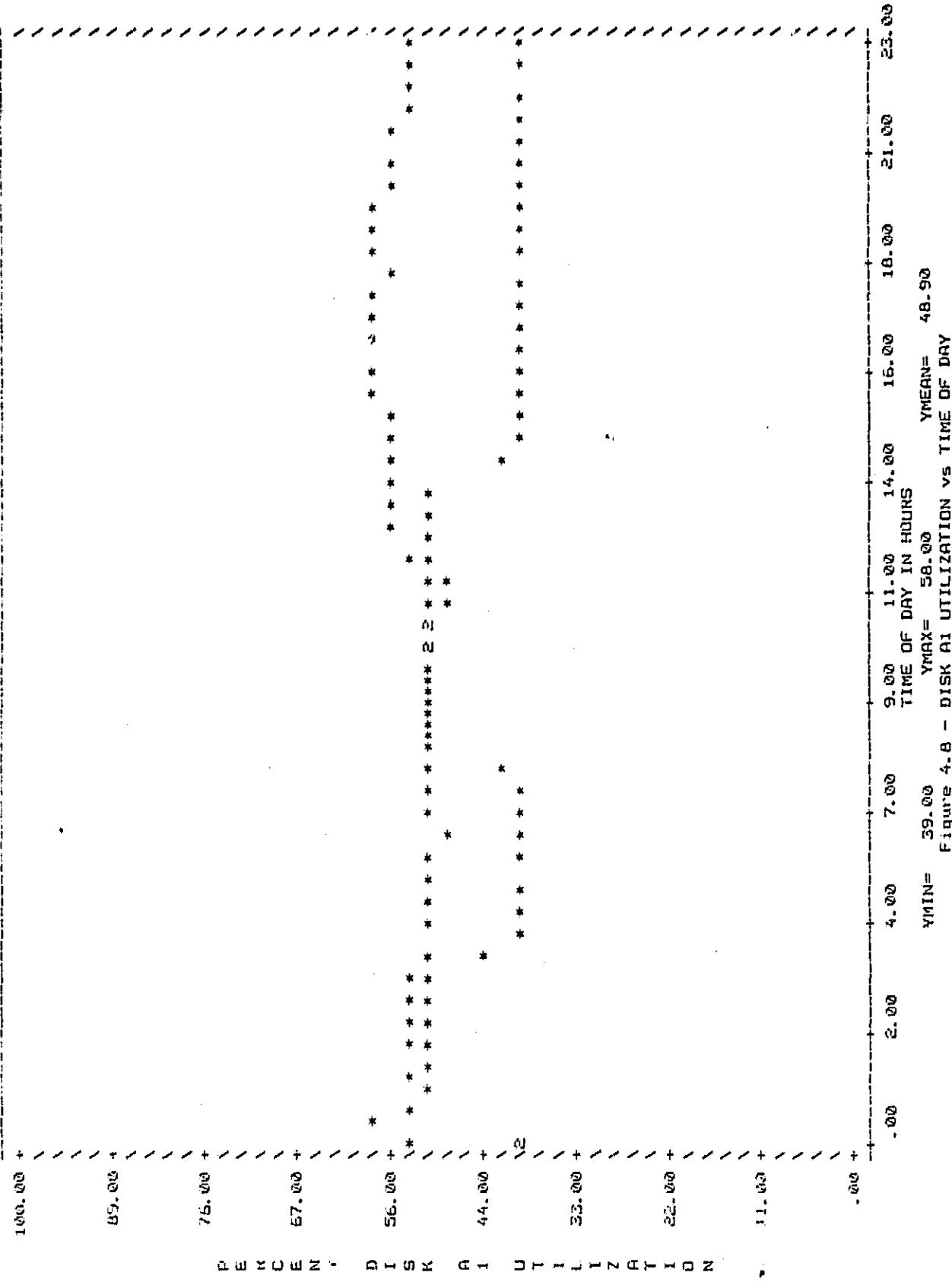


Figure 4.7 - DISK AD UTILIZATION VS TIME OF DAY



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APPENDIX D

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AND

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